THE

JOURNAL OF GAS LIGHTING,

WATER SUPPLY, & SANITARY IMPROVEMENT.

[REGISTERED AS A NEWSPAPER.]

VOL. XXVI. No. 657.] LONDON, DECEMBER 14, 1875. [27TH YEAR.] Price 6d.

RAMSAY'S NEWCASTLE CANNEL COAL. Analysis—10,000 cubic feet of gas per ton of coal; 26-candle gas; 13¼ cwt. coke per ton of coal.
The London Exhibition in 1851 was lighted with gas made from Ramsay's Cannel.
RAMSAY'S PATENT CONDENSED COKE.
DO. GARESFIELD COKE.

RAMSAY'S FIRE-CLAY ARTICLES.
GAS-RETORTS, introduced 1828. FIRE-BRICK WORKS, established 1804. FIRE-CLAY SANITARY PIPES, CHIMNEY-TOPS, and all Goods made of Fire-Clay. The Fire-Clay is worked from Blaydon Main Colliery, is of excellent quality, and no expense spared in perfecting every article. The FIRE-BRICKS (marked "RAMSAY") are to be seen in all parts of the world, and the Works are the most extensive in the Kingdom.
Manufactories—Derwenthaugh, Swalwell, and Hebburn Quay, near Newcastle-on-Tyne; and London Wharves—Falcon Wharf, No. 80, Bankside; and Honduras Wharf, Cubit Town. Large stocks kept.
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GENUINE TORBAY PAINT
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SPECIAL GASOMETER PAINT
(Mixed ready for use).
These Paints are now used in 100 Country Gas-Works, and by all (but one) of the London Gas Companies, on Gasholders, Scrubbers, Purifiers, &c. They will cover tar effectually. Also used by the Admiralty, War Office, Railway Companies, Founders, &c.
They prevent and arrest rust, and protect iron from the action of water, sulphurous and gaseous exhalations.
The covering powers are considerably greater than those of any other Paint.—*See "Engineer," Nov.* 2, 1866.
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(SUCCESSORS TO SAMUEL CALLEY. ESTABLISHED 20 YEARS.)
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WORKS: BRIXHAM, TORBAY.

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SPECIALITIES IN WOOD GRIDS
FOR
PURIFIERS & SCRUBBERS
MADE FROM THE BEST QUALITY
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SCRUBBERS FITTED WITH MR. LIVESEY'S BOARDS AT MODERATE COST.
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JOSEPH COWEN and CO.,
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Were the only parties to whom a PRIZE MEDAL was awarded at the GREAT EXHIBITION of 1851, for "GAS-RETORTS and OTHER OBJECTS in FIRE-CLAY," and they were also awarded at the INTERNATIONAL EXHIBITION of 1862, the PRIZE MEDAL for "GAS-RETORTS, FIRE-BRICKS, &c., for EXCELLENCE of QUALITY."
J. C. and Co. have been for many years the most extensive Manufacturers of Fire-Clay Retorts and Fire-Bricks in the Kingdom. Orders for Fire-Clay Retorts of all shapes and dimensions, and to fit any shaped Mouthpiece, Fire-Bricks, and every other article in Fire-Clay, are promptly executed at their Works as above.
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THE WEDNESBURY TUBE-WORKS, WEDNESBURY;
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Established at the commencement of Gas Lighting.
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Also, STATION-METERS, PRESSURE-GAUGES, STREET-LAMPS, REGULATORS, &c.
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RETORTS SET, AND GUARANTEED TO BURN OFF A CERTAIN AMOUNT OF COAL, OR ELSE NO MONEY TAKEN FOR THE CONTRACT.
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LONDON, 1862. CLASS X.
LONDON, 1862. CLASS XXXI.
PARIS, 1867. SILVER MEDAL.
AMSTERDAM, 1869.
DIPLOMA D'EXCELLENCE.
VIENNA, 1873. THE ONLY MEDAL.
MANCHESTER, 1875. SILVER MEDAL.

GEORGE GLOVER & CO.,
MANUFACTURERS OF
IMPROVED DRY GAS-METERS,
WARRANTED TO MEASURE CORRECTLY, AND NOT TO VARY.

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THEY KEEP IN STOCK METERS OF ALL SIZES, UP TO 300 LIGHTS.

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SILVER MEDAL, PARIS EXHIBITION, 1867.

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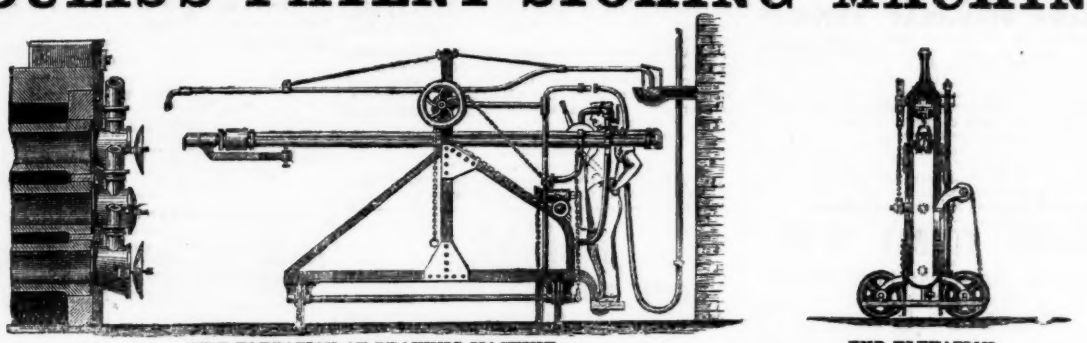

SIDE ELEVATION OF DRAWING MACHINE. END ELEVATION.

(The Charging Machine will be Illustrated in next week's Advertisement.)

Makers: TANGYE BROTHERS and HOLMAN, London and Birmingham; ADAM WOODWARD and SON, Manchester ROBERT LAIDLAW and SON, Glasgow; MASCHINENBAU-ACTIEN-GESELLSCHAFT HUMBOLDT, Kalk bei Deutz;
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WORTLEY FIRE-BRICK WORKS,

NEAR LEEDS,

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Where is always kept a Stock of Retorts, Fire-Bricks, Terra Cotta Ware, and Drain-Pipes.

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THE MEDAL FOR 1862.

The only Prize Medal awarded for TUBES & FITTINGS.

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LAP-WELDED, LOCOMOTIVE, MARINE, and other BOILER TUBES;
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PURIFIERS, CONDENSERS, SCRUBBERS, RETORTS, VALVES;

IMPROVED WROUGHT-IRON RETORT-LIDS, CROSS-BARS, & SCREWS;

AND GAS APPARATUS OF EVERY DESCRIPTION.

SOLE MANUFACTURERS OF LIVESEY'S PATENT GASHOLDER MAN-LID,

By use of which Man-lid, inlet and outlet pipes can be examined and cleansed without loss of gas in crown of holder, or ingress of atmospheric air.

ROOFS, GIRDERS, BRIDGES, AND BOILERS OF ALL KINDS.

Drawings, Specifications, and Estimates supplied on application.

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LANCASHIRE GAS-METER COMPANY,

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FALCON STREET, OLDHAM,

MANUFACTURERS OF

GAS-METERS, GOVERNORS, EXPERIMENTAL GASHOLDERS, &c.

HENRY THOMAS, Managing Director.

JOHN WRIGHT AND CO., ESSEX WORKS, BIRMINGHAM,

Beg to call the attention of MANAGERS and DIRECTORS of GAS COMPANIES to the following letter which they have lately received.

COPY OF LETTER RECEIVED FROM MAGNUS OHREN, Esq.

Crystal Palace District Gas Company, Lower Sydenham, S.E.

To Messrs. John Wright and Co., Essex Works, Birmingham.

Dear Sirs,—In reply to your inquiries, I am glad to state that the use of GAS COOKING AND HEATING STOVES has been a complete success here. We have several hundred in use in our districts. We also find it advantageous to let out Stoves at a small rental. We have now 275 Stoves at rent.

The Stoves you make I can with confidence recommend, having so many in use, and giving satisfaction. I need scarcely point out to you the advantage to Gas Companies to recommend the use of Gas Stoves to their Gas Consumers, even where they do not supply them on sale or rent, as the use of Gas Stoves brings day consumption, and thus the Company make a profit by day as well as by night.—I am, dear sirs, yours faithfully, MAGNUS OHREN.

Size, 25½ in. high; 14 in. wide; 12½ in. back to front.

Price 50s., complete with Pan and Gridiron.

GAS HEATING STOVES

(TERRA COTTA AND IRON).

THE CHEERFUL STOVE.

COOKING STOVES.

BREAKFAST COOKERS.

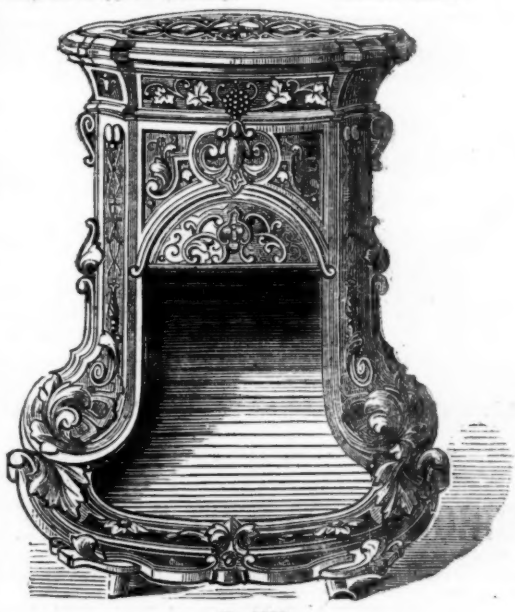
BATHS HEATED by GAS

GAS STOVES

For Boiling, Broiling, Preserving, Heating Flat Irons, and for all other Domestic Purposes.

Gas Companies and the Trade who have not our Illustrated Catalogue are respectfully requested to apply for same.

A LIBERAL DISCOUNT to the TRADE.



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THE CHEERFUL GAS STOVE, with Copper Reflector,

Has all the appearance of a Bright Fire.

PRICE from 32s.

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MANUFACTURERS OF

"WET" & "DRY" GAS-METERS IN IRON & TIN-PLATE CASES,

STATION-METERS AND GOVERNORS, STREET-LAMP METERS, BOXES, AND REGULATORS FOR THE AVERAGE METER SYSTEM.

TO GAS COMPANIES, ENGINEERS, &c.

These Works are in full operation, and it will be the aim of the New Company not only to keep up the excellent workmanship of their predecessors, but, by the introduction of special machinery, to manufacture **Meters of a higher standard than is usually given, without increasing the cost.**

Special attention is invited to the Compensating Wet Gas-Meter of De Castro and Burton, which is now becoming so generally adopted, and is more simple in construction than any other Compensating or Ordinary Wet Meter. There is but one centre of friction to be overcome by the gas. By its self-adjusting principle it maintains an unvarying water-line; and the reservoir contains sufficient water to supply the Meter for twelve months without attention. It is unaffected by "tilting," and cannot be "flooded" by any pressure.

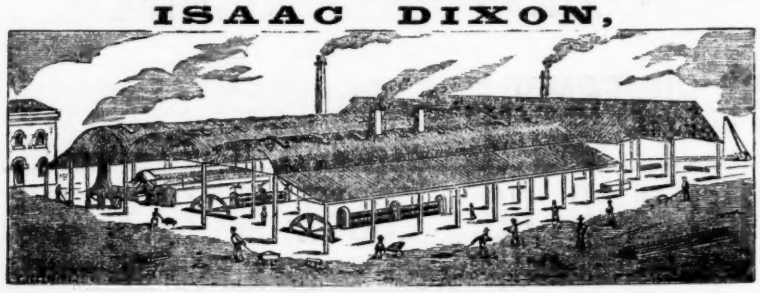
The Company also manufacture Dry Meters upon the most improved principle, and all their Meters being made to standard gauges, the most accurate measurement is obtained.

Attention is also called to their Dry Meters in Wood Cases, as used by some of the London Gas Companies. These Cases are a great preservation to Tin-plate Meters, especially in seaport towns, where the air is impregnated with salt; they are also particularly suited for export.

The Company repair or convert every description of Wet Gas-Meters to De Castro and Burton's Patent.

ISAAC DIXON,

WINDSOR IRON-WORKS, LIVERPOOL.



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Manufacturer of SELF-SUPPORTING GALVANIZED CORRUGATED, CURVED, and every kind of IRON ROOFING, CHURCHES, SCHOOLS, SHEDS, and IRON BUILDINGS.

WROUGHT and CAST IRON GIRDERS, BRIDGES, TANKS, &c., and all kinds of WIRE WORK, FENCING, GATES, HURDLES, &c., for Home or Abroad.

DIXON'S CELEBRATED SELF-SUPPORTING IRON ROOFS are specially suitable for Forges, Rolling-Mills, Iron-Works, Shipbuilding Yards, Mines, Collieries, Gas and Water Works, and for general purposes.

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MANCHESTER EXHIBITION OF SCIENTIFIC INDUSTRY — GOLD MEDAL — 1875

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Patentees and Manufacturers of Registered Apparatus for Cooking and Heating by Gas, Complete Kitcheners for Families, Hotels, Clubs, &c. Ovens for Baking and Roasting. Grillers for Broiling. Boilers and Steamers for general use. The New Patent Tubular Safety Gas Boiler; also Heating and Ventilating Stoves, besides other Culinary and Warming Apparatus of their invention, and for which they have been awarded Prize Medals in 1871, 1872, 1873, and 1874.

They have also just been awarded by the Jurors of "The Exhibition of Appliances for the Economy of Labour," now being held at Manchester, the

GOLD MEDAL

For their collection of Patent Atmospheric Gas Apparatus, comprising New Patent Kitcheners for Roasting, Baking, &c., Steamers, Bath Boilers, Heating and Ventilating Stoves, Ornamental Drawing and Dining-room Fire Grates, and other Gas Apparatus, for their novelty, design, workmanship, and utility.

For Pamphlets on the "Advantages of Cooking and Heating by Gas," and Price Lists, &c., apply at the

Adamas Works, 54 to 66, ST. PAUL'S ST., NEW NORTH RD., LONDON, N.

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Sole Licensees and Agents in Great Britain for

GIROUD'S PATENT RHEOMETER.

This Instrument is easily fixed under any burner; it regulates the volume of gas to be consumed, notwithstanding the size of the burner or the variations of pressure.

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(Special Illustrations and Prices on application to our Works.)

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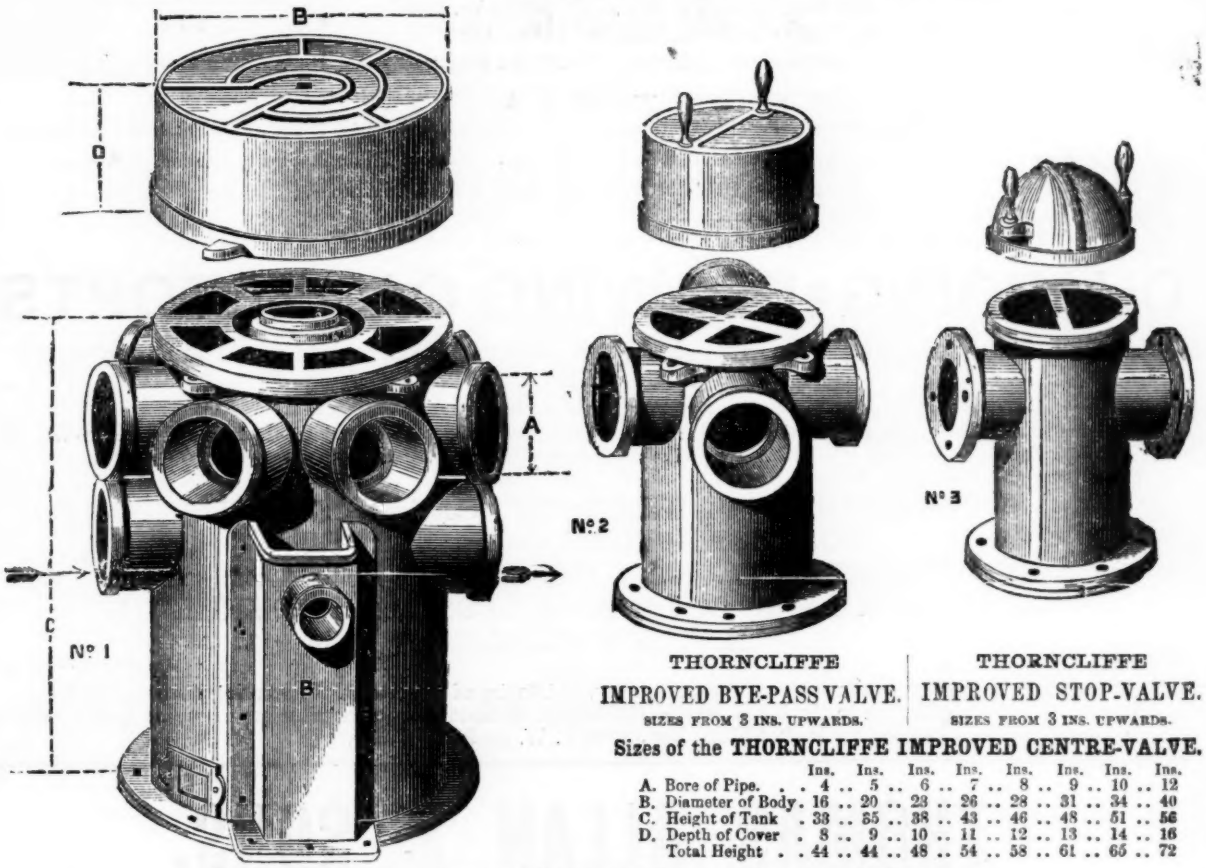
TO THE EMPRESS OF AUSTRIA THE COUNT OF FLANDERS &C

MESSRS. NEWTON, CHAMBERS, & CO.,

THORNCLIFFE IRON-WORKS, NEAR SHEFFIELD.

IMPROVED CENTRE-VALVES.



THORNCLIFFE IMPROVED BYE-PASS VALVE. SIZES FROM 3 INS. UPWARDS.

THORNCLIFFE IMPROVED STOP-VALVE. SIZES FROM 3 INS. UPWARDS.

Sizes of the THORNCLIFFE IMPROVED CENTRE-VALVE.

	Ins.	Ins.	Ins.	Ins.	Ins.	Ins.	Ins.	Ins.
A. Bore of Pipe. . .	4 ..	5 ..	6 ..	7 ..	8 ..	9 ..	10 ..	12
B. Diameter of Body.	16 ..	20 ..	23 ..	26 ..	28 ..	31 ..	34 ..	40
C. Height of Tank .	33 ..	35 ..	38 ..	43 ..	46 ..	48 ..	51 ..	56
D. Depth of Cover .	8 ..	9 ..	10 ..	11 ..	12 ..	13 ..	14 ..	16
Total Height . .	44 ..	44 ..	48 ..	54 ..	58 ..	61 ..	65 ..	72

In all cases the Covers are cast heavy enough to resist any required pressure.

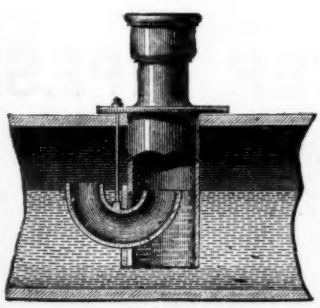
The advantages derived from the adoption of these Valves are so manifest and cardinal that in the immediate character of the change—the simplicity of the machine—the facility affording for cleaning out connexions between Valve and Purifier—the perfect collection and delivery by suitable overflow of the ammonia, at a greatly diminished depth from ground-line over the old form of Valve—the advantage of connecting on the same level, and at any angle, or opposite to each other, the inlet and outlet pipes without dip or rise—the clear acquisition of space in the purifying-house, by being able to place the boxes nearer together, the new Valve being entirely under the floor—and lastly, though of the greatest importance, the passage of crude and unpurified gas during the change is minimized to the merest fraction, thus preventing the fouling by impure gas the delicate machinery and easily affected exposed movements of the station-meter, thereby preventing the introduction of the enemy (unpurified gas) into the gasholder. Also a dead abutment is offered to all back pressure, imparting thereby to the gauges, governors, and hydraulic seals, a steadiness of action never realized with the once famous, but now fast becoming obsolete, Hydraulic Centre-Valve.

N., C., and Co. also Manufacture and Erect

PURIFIERS, CONDENSERS, SCRUBBERS, GASHOLDERS, ROOFS,

And every description of Gas Machinery.

TENDERS GIVEN FOR WORK FIXED COMPLETE IN ANY PART OF THE KINGDOM.



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Messrs. N., C., and Co. are also the Sole Agents for

HAWKINS' PATENT SELF-ACTING HYDRAULIC DIP-PIPES.

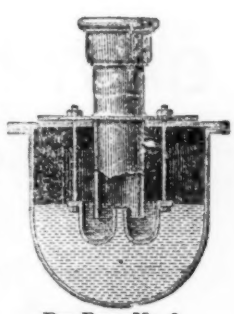
By their use the whole of the pressure caused by the Seal in the Hydraulic Main is entirely avoided, thus securing the many advantages long sought for.

Over 50 Gas Companies have already been supplied with them, many of which have been using them throughout their entire works continuously for over two years.

They can be applied to existing Hydraulic Dips, and at a very small cost.

They seal themselves in the same manner as the ordinary dip-pipes, therefore they are not likely to get out of repair.

By the aid of the adjusting screws they can be made to work on the old principle at pleasure.



Dip-Pipe, No. 2.

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The Patented Machinery has secured the approbation of all Engineers who have visited the MAIDSTONE GAS-WORKS, *where it is in full operation, and may be inspected at any time on application to the Manager.*
The advantages attending its use are—

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REDUCTION IN LABOUR AND LESS DEPENDENCE ON SKILLED STOKERS.

A Pamphlet containing a description of the Machinery, and Copies of Reports on the working of the same, &c., will be forwarded on application to the MANAGING DIRECTOR, Maidstone. Communications may also be addressed to R. P. SPICE, Esq., or to F. W. HARTLEY, Esq.

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SIZES: ¾ to 12 inches at GLASGOW.
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A LARGE STOCK KEPT, AND PRICES MODERATE.

Freight to London, in the Stream, 10s. per ton from Stockton; 12s. 6d. from Glasgow.

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NEAR BLACKBURN, LANCASHIRE.

(ESTABLISHED 1835.)

ORLANDO BROTHERS, LIMITED,

MANUFACTURERS OF PATENT CLAY RETORTS,

AND EVERY DESCRIPTION OF

TUBULAR GLAZED SEWERAGE PIPES, BENDS, JUNCTIONS, ETC.

FIRE-BRICKS, TILES, BLOCKS, AND CHIMNEY-TOPS

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IMPROVED VENTILATING SUN-LIGHTS

WITH TALC REFLECTORS AND SELF-ACTING VALVES

TO PREVENT DOWN-DRAUGHT;

VENTILATING GLOBE LIGHTS for DINING-ROOMS, LIBRARIES, &c.

Ormolu, Bronze, & Crystal Gaseliers;

MEDIÆVAL CHURCH WORK AND CORONÆ

COCKS, VALVES, and FITTINGS for GAS, STEAM, and WATER;

COLUMNS, BRACKETS, & STREET LANTERNS;

BLACK AND GALVANIZED BARREL COMPO AND TIN PIPE.

GAS ENGINEERS,

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Drawings and Prices upon application.

SELF-ACTING REMOVABLE DIP-PIPE,

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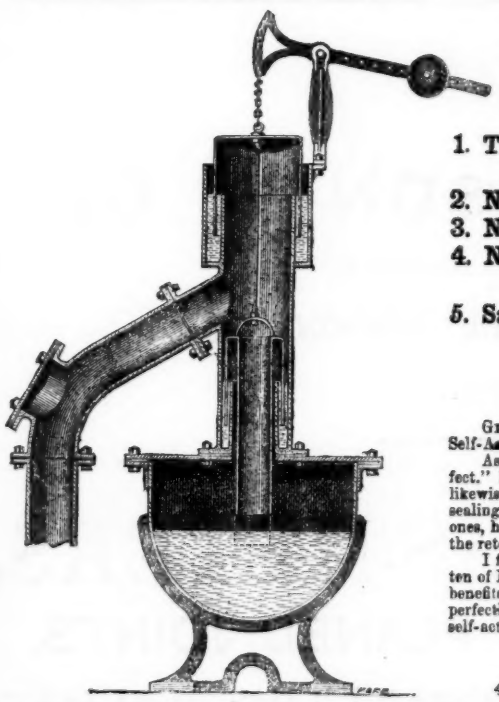

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3. No scurfing is required.
4. Never a choked Ascension-Pipe.
5. Saves Fuel and Wear and Tear.
6. Gets 10 per cent. more Gas out of the Coal, and a higher Illuminating Power.
7. Is never out of order.
8. Requires no attention.
9. Is perfectly automatic in its action.

TESTIMONIAL.

Metropolitan District Asylum, Caterham, Surrey, Dec. 14, 1874.

MESSRS. CHANDLER AND STEVENSON.

GENTLEMEN,—I have much pleasure in bearing testimony to the complete working of your "Patent Self-Acting Dip-Pipes," which have now been in constant operation over three months.

As regards the action of the apparatus, I can describe it no better than by calling it "simply perfect." Immediately the retort is charged and the lid secured, the small holder rises, which lifts the Dip; likewise the instant the gas is permitted to escape at the mouthpiece the holder falls, thus perfectly sealing the Dip. I am fully convinced of the superiority of these Self-Acting Dips over Non Self-Acting ones, having experienced the fact that stokers do occasionally neglect to unseal the Dip after charging the retort, thereby causing a waste or loss.

I feel that it is quite unnecessary for me to say more on the subject, excepting that, having had ten of Messrs. Chandler's Dip-Pipes in use more than one year, and having experienced the great benefits derived thereby, inasmuch as the yield of gas from the coal is greatly increased, and the retort perfectly free from carbon and other advantages, and seeing that the same Dip has been made perfectly self-acting by the second patent, I feel convinced that this is the right thing.—Yours obediently,

W. CRICKMAY, Resident Engineer.

For terms of use and cost, apply to Mr. G. W. STEVENSON,

4, WESTMINSTER CHAMBERS, VICTORIA STREET, S.W.

MESSRS. CHANDLER & SONS,

Gas Engineers, Patentees, and Contractors, Triennial Contractors to Her Majesty's Government,

UNDERTAKE THE

ERECTION OF GAS OR WATER WORKS;

CONTRACTORS FOR PIPE-LAYING AND GAS-FITTING.

SOLE MANUFACTURERS OF THE CHANDLER AND STEVENSON PATENT SELF-ACTING DIP-PIPE.

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Dublin, 1865

The SIX MEDALS AWARDED to THOMAS GLOVER for

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The latter being the Highest Medal awarded for Dry Gas-Meters by the Imperial Commissioners for the Universal Exhibition, Paris, 1867.

Paris, 1867.

THOMAS GLOVER & CO.,

DRY GAS-METER MANUFACTURERS,

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METERS FOR MEASURING WATER.

CONTENTS.

	Page
Circular to Gas Companies:—	
The Metropolitan Board of Works on the Proposed Amalgamations	865
The Gas Legislation of 1875	866
The Present Price of Metropolitan Gas Shares	866
Success of the Average Meter System in Paddington	866
Purchase of the Burslem Gas-Works by the Local Board	866
Water and Sanitary Notes:—	
Proposed Inquiry into the Cause of Typhoid Fever at Croydon	866
Plans for the Disposal of the Sewage of Rotherham	866
The Goux System at Halifax	867
The Future Water Supply of Liverpool	867
Sequestration of the Rates at Newcastle-under-Lyne	867
Leading Article:—	
Gas Legislation in 1875	867
Correspondence:—	
Somerville's Automaton Register of Illuminating Power	868
Apparatus for Extracting Sulphur from Spent Oxide	868
Gas-Exhausters and the Deposit of Carbon in Retorts	868
Legal Intelligence:—	
High Court of Justice—Chancery Division—	
The Attorney-General *v.* The Hyde Chemical Company	869
Patterson *v.* The Gaslight and Coke Company	869
Re the Eupion Fuel and Gas Company	874
Manchester Winter Assizes—Frauds by the Superintendent of the Bolton Corporation Water-Works	874
Westminster Police Court—Proceedings under the Companies Clauses Act to Commit for Non-Payment of Gas-Rent	874
Miscellaneous News:—	
Death of Mr. W. B. Hack	868
New Worsley Gas-Works	868
Preston Public Lighting	868
Metropolis Gas Supply	874
Metropolis Water Supply	877
Meeting of the South Metropolitan Gas Company	877
A Solid Gas-Flame	877
Drawing and Charging Gas-Retorts	878
Birmingham Water Supply	880
Iron and Coal Trades of Sheffield, South Yorkshire, and North Derbyshire	880
Iron and Coal Trades of South Staffordshire and East Worcestershire	880
Iron and Coal Trades of Lancashire	880
Coal and General Trade of the North	880
Trade Notes from Scotland	881

THE JOURNAL OF GAS LIGHTING,

WATER SUPPLY, & SANITARY IMPROVEMENT.

TUESDAY, DECEMBER 14, 1875.

Circular to Gas Companies.

As we anticipated would be the case, the Metropolitan Board of Works have determined on offering the most strenuous opposition to the scheme for the amalgamation of the Imperial and Independent Companies with the Chartered. The lengthy report of the Parliamentary Committee of the Board will be found *in extenso* in another column, and this report is to be sent to the Board of Trade, as a reply to the communication of that department, requesting the opinion of the metropolitan authority on the scheme. But that the near approach of St. Thomas's Day disorganizes the Common Council of the City of London, and renders the members insensible to all considerations but those necessary to secure their re-election to dinners, we should, no doubt, have had a similar report from the Gas Committee of the Corporation of London. It is safe to come presently, however, for have not the Metropolitan Board spoken, and the relations of the two bodies are just those of the butler and the page in "Oliver Twist"—"I say what Mr. Brittles says."

It by no means follows that, because the metropolitan authorities oppose the scheme, it will not be successful. The officials of the Board of Trade may look farther ahead than the narrow-minded authorities, and may see that, notwithstanding all that can be alleged as to the disastrous results to consumers, of past amalgamations, the promise of the future fully justifies amalgamation of the widest kind—that is, complete. We cannot, even with this document of the Board of Works before us, say that amalgamations have not been beneficial. But this we say, most emphatically, that, in the course of no distant time, general amalgamation must be productive of most advantageous results to consumers. The means by which this will be accomplished can only be provided by slow degrees, but the final effect is certain. We need not hesitate to admit that the advantages of amalgamation to the companies are immediate, to the consumers somewhat remote; but in the end the advantages must be equally shared.

No doubt the immediate result of amalgamation would be, to some consumers, the *levelling up* of price, to which we have so often referred. Well, this would also be the consequence of purchase by the authorities, which is again urged as the *panacea* for all the ills of gas consumers. The authorities, if they bought the undertakings to-day, could not afford to sell gas for less than 3s. 9d. all round, and at that price would experience a difficulty in finding the money for contingency and renewal funds, and other moneys necessary for maintaining their position, letting alone profits in aid of rates. We refer once more to this question of purchase because it crops up everywhere—at the Metropolitan Board of Works, and at a meeting of the South Metropolitan Gas Company. At the former, it is argued that the companies must not be allowed to increase their share capital, because it would render their purchase more costly; at the latter, the sliding scale and a three shilling and ninepenny standard price is insisted on, because it would make the undertaking more valuable. We have done with the sliding scale from one point of view, but we may intimate that, if it is to prove the boon to the companies which some would have us believe, the ultimate cost of purchase must be greatly enhanced. To-day the authorities may buy up all the companies at 25 years purchase of maximum dividends; but who, as we have said before, knows what they may cost after some years of the sliding scale.

We shall not follow the committee of the Metropolitan Board through all their report, but must make a few remarks. The review of previous amalgamations is not exactly candid. It proceeds on the assumption that what the companies, who have been absorbed by the Chartered, did, before they amalgamated, they might have continued to do if they had retained a separate existence. This may be true to some extent, but it is certain that each one would have been compelled, in the "famine" years, to run up their price to the maximum. The special circumstances of the Great Central Company, after Higgs's defalcations, would have obliged that company to do so. This would have brought them to a level with "neighbouring companies." What might have happened in the other cases it is easy to see. The Equitable might have come out of the trial pretty well, but the Western must have suffered severely. But what is the insinuation in this report? It is either that the directors of the three companies were blind and fatuous, or that they deliberately *collogued* with the Chartered Company to defraud their customers. Our readers know who these directors were, and we ask whether they are not to be considered as honest and as intelligent as any member of the Board of Works?

It is curious to notice that only a passing remark is made in the report on the proposed amalgamation of the Imperial Company. We must infer, therefore, that this is practically unopposed by the Board. The circumstances of the Chartered and Imperial Companies are so nearly alike that opposition was hardly to be expected, except upon sentimental grounds—a vague fear of the effects of combinations. The force of the report is directed against the amalgamation of the Independent Company, which we have before admitted would, in all probability, involve a levelling up of price. It does not follow necessarily, because a company may, if they choose, charge differential rates in separate districts. It might be inconvenient, and would complicate book-keeping to do so; still, if this probable rise in price were the only obstacle to present amalgamation, it might, we think, be got over.

The Metropolitan Board boast that one merit of the Regulations Bill is, that it will not ensure uniformity of price. In another breath the leading members of the Board declare that the purchase of the companies offers the only satisfactory solution of the difficulty, and purchase will, of course, result in uniformity of price; but we need not repeat what has been said before. We fully appreciate the views of the consumers in the Independent district, and are not at all surprised at their protestations; but we must point out to them that what they object to now, is certainly in store for them presently. They oppose amalgamation to-day—they may see it advisable to oppose purchase to-morrow.

The position of the Independent Company is, we rather think, a peculiar one. Their district is all built over; their works, we fancy, could not be extended on their present site, if a necessity for extension should arise, which we take to be extremely improbable. Their capital account may be considered to be closed. If they preserve an independent existence, it is very doubtful whether the price of gas could be reduced; and if they were purchased, the price would certainly be advanced. The consumers are, in fact, on the horns of a dilemma. They are told to resist amalgamation, and they are invited to support purchase.

Reading and re-reading this report, we are satisfied that the Metropolitan Board have failed to make out a good case against the amalgamation. With respect to the Imperial Company, they allege nothing, and that amalgamation is altogether unopposed. In the case of the Independent, there does arise the question of a differential rate, which will, no doubt, receive attention. The objection made to the application of the reserved funds of the Imperial and Independent Companies is very faint. The pensions granted would be very small in relation to the revenue of the combined companies, and their absence from that account would not "prevent a correct comparison being made with other "companies," which the Board think so desirable.

We may pass over that part of the report relating to the pension of Mr. Andrews, the secretary of the Equitable, with the remark, that something very like the transaction was repeated the other day by one of the Board's model companies, the

Ratcliff; but we understand that an attempt is being made to deprive the secretary of that company of the increase of salary voted by his directors, a proceeding which, no doubt, the Metropolitan Board will approve, but which we regard as dishonourable.

There is another passage in the report which we regard as sheer impertinence. It asserts, that in case of amalgamation, the directors from the Independent Company will be holders of preference stock, and therefore will have no incentive for the exercise of prudence and economy in management. This is only another way of saying that they cannot be honest men and gentlemen. The report winds up with the expression of a hope that the Board of Trade will save the ratepayers of London the expense of another parliamentary contest. We do not think they can do anything of the sort. Another select committee must investigate metropolitan gas affairs, and unless rumour deceives us, some queer things may be expected to turn up in the course of the inquiry.

Mr. Newton is, of course, violently opposed to the Bill which the Chartered Company will promote next session. He will not listen to any proposal for raising the initial price, even when it is qualified as the company propose, nor will he admit any claim to a reserve-fund, unless it is formed in the way the Regulations Bill will allow. He objects to loans at 6 per cent., for that, he seems to argue, would be merely preference capital under another name. But we need not continue. Nothing the Chartered Company could possibly do would satisfy Mr. Newton. We shall see what can be done with another select committee, and shall meet Mr. Newton again.

Our readers will have noticed the growing taste of the Metropolitan Board for loaning money, and will not be astonished to see a member recommend that they should lend to the gas companies. We have not yet heard the rumour, but we have no doubt it exists, that the Board will, next year, apply for power to start a *Mont de Piété* in imitation of some continental municipalities.

One objection now raised to general amalgamation is, that it will create a huge monopoly of residual products, which will be detrimental to the interests of the public. As regards the chief residual—coke—we are inclined to think that the public might be benefited; but the probability is that the coke traffic would continue to go on much as it does now. Certain works are advantageously situated for the sale of coke, and at these the best prices will always be obtained. No monopolists could ever make coke at Beckton worth as much as it is in the Old Kent Road, and it is impossible to force up the value of such a commodity. A monopoly of tar would be a small blessing to a company, unless they worked it up themselves. It may drop in value any day. Next to coke, the residual which has the most stable value is ammoniacal liquor, and this will probably increase in worth. If amalgamation be ever brought about, we should strongly recommend the combination to take up the utilization of products.

We give to-day a very brief *résumé* of the legislation of the past session, affecting provincial gas companies. A glance over the provisions of the Acts passed, seems to show that Parliament treat country companies with much more liberality than they are disposed to show to the metropolitan undertakings. While some of these latter were being pushed to extremities last session, the former obtained, without much opposition, all the advantages which have been conferred by special Acts during the last few years. They got power to raise capital, and borrowed money in the usual proportions. The Bath Company, it will be seen, met the economizers half way, and got power to raise their new capital at 7 per cent. and 5 per cent., such capital to be issued together, in the proportions mentioned in another column. We regard the arrangement as sound and liberal—much better than that enacted for the Commercial Company, and infinitely to be preferred to that proposed by the Chartered Company. The Bath Company take no power to raise loans. The capital, at a low rate of interest, is to be share capital without preference. Most certainly, some of our country friends have very sound opinions on finance and trade. The only thing of *permanent* value that a gas company possess is land, and we are inclined to think it impolitic to load an undertaking with loan capital, beyond the value of such land. Gas-works and plant, we are often told, may some day become old bricks and old iron, which would go but a short way to satisfy the claims of the mortgagees of a company who had raised half their capital by way of loan. The Bath Company have set an excellent example, which we hope to see copied.

Three companies obtained power to raise their maximum price. In no one of these cases, so far as we can see, could stronger reasons be urged than might be brought forward in favour of some metropolitan companies. In the case of the Worthing Company, the advance is made contingent on an increase in the price of coal, which, again, is a satisfactory arrangement. A simple and inexpensive means of ascertaining the cost of coal to the company is prescribed. Only one statutory company took power last session to sell their works to a Corporation. The purchases actually made we shall notice in our next issue.

Some reaction has taken place in the speculation in metropolitan gas shares, and the prices have receded. This is not to be wondered at, for the recent prices have touched, if they have not exceeded, the fair market value. Gas proprietors, however, need feel no alarm. Uncertain as may be the action of the Government with respect to amalgamation, and doubtful as may be the result of the next parliamentary campaign, the substantial value of gas shares is not likely to be affected, and we hope that proprietors will not be seduced into a panic, which it may be the aim of some speculators to bring about.

After a year's trial of the average meter system, the Paddington Vestry express perfect satisfaction with the results. It is said that a saving of £1000 has been effected in the past year, and that the parish has been better lighted than it ever was before. The report states that no meter has registered a consumption of 5 feet per hour. We trust that the regulators are well attended to, or the gas company may be considerable losers.

We understand that the offer of the Burslem and Tunstall Gas Company, to sell their works to the Local Board for £80,000, has been accepted. The paid-up capital of the company is, we believe, £36,000.

Water and Sanitary Notes.

The President of the Local Government Board has granted the wish of the Croydon deputation. Dr. Buchanan has been directed to inquire into the cause or causes of the late epidemics of typhoid fever. We could wish for a searching investigation, but can hardly hope for one conducted by a medical inspector who comes from Whitehall with necessarily a foregone conclusion in his mind. The medical department of the Local Government Board have made up their minds that water, and water alone, is the carrier and distributor of typhoid poison. We are told already that the cause has been discovered at the water-works. A huge waste-pipe in the water tower has been found to have direct connexion with the sewer. This must have been the case ever since the pipe was put up—how many years ago we do not know. Croydon, we are told, has not, until May last, suffered from an outbreak or epidemic of typhoid for ten years; but we think we are right in stating that the district has never been long free from sporadic cases of the disease. Why, with this huge pipe permanently established in connexion with the sewer, has not the disease broken out before, and why did it cease in June last, to break out again in September? Then, again, we are told that the specific poison is a solid germ. Will Dr. Buchanan get it explained to us, how these germs get converted into vapour, still retaining their specific character, to be again absorbed by water. And further, why, if this be the fact, we have not thousands of cases of fever where we have only tens. Dr. Carpenter told an interesting story at the Society of Arts a week ago. He said the cattle at the Beddington Sewage Farm were perfectly free from foot and mouth disease, until an affected herd were pastured in a field at some distance; then, when the wind blew in the right direction, the infection was carried across the fields to the cattle on the sewage farm. Perhaps it would be worth while to inquire the share which the atmosphere may have had in propagating typhoid at Croydon. We express no opinion, and only desire to have the truth—or such an approximation to it as we can possibly arrive at—elicited. At present, and with the information on the subject now before us, we must protest against the imputations always cast on water undertakings whenever an outbreak of cholera or typhoid fever occurs. We shall presently hear more of this huge waste-pipe in the water tower, and shall learn more about its connexion with the sewer, and with the water supply.

The Rotherham Town Council have called in Mr. Bailey Denton and Mr. Brundell, to advise them as to the disposal of their sewage, and the difficulties in the way of a Local Board coming to a conclusion may be guessed from a comparison of the two reports. The first-named gentleman, estimating the quantity of sewage to be disposed of daily at 400,000 gallons, and finding land in the neighbourhood costly, recommends the council to acquire some 60 or 70 acres for cleansing the sewers by intermittent downward filtration. Mr. Brundell, however, calculates the amount of sewage, which will have to be disposed of at once, at 560,000 gallons per day, and he recommends the institution of a sewage farm of 250 acres. The site he proposes is at a distance from Rotherham, and it is intimated that farmers may be persuaded to take sewage from the pipes along the route; but it is very properly pointed out that the Local Board must be prepared to deal with the whole of it. The Town Council of Rotherham have a hard nut to crack.

In Halifax, as most of our readers will remember, the Goux system for the disposal of excreta and house refuse has been in operation for some time, under the conduct of a company. It has not, we gather, proved a good speculation financially, but the Town Council are very well satisfied with the sanitary results of the system. The contract of the company with the Corporation will shortly expire, and the latter body have just decided on purchasing all the plant and property of the company, and working the system under their own superintendence. They have given notice to the inhabitants that, after the 23rd of January next, they will be required to empty the closets themselves, unless they agree with the Corporation, who offer to empty them for a yearly payment of 5s. each. As the closets have hitherto been emptied without a direct charge, although each has cost the Corporation 12s. 6d. a year, some in the Council strongly opposed the exaction of 5s. We shall be glad to see more and more attention paid to the dry carriage of excreta. It has its unavoidably repulsive side, which, in these squeamish days, is a great disadvantage.

The Water Committee of the Corporation of Liverpool have under their consideration an amended scheme for a water supply from Windermere, the execution of which, it is said, will not cost more than one million and a half. Particulars as to the route the water will be conveyed have not yet come to hand. At the same time, they have decided to spend £200 more on the endeavour to find a firm foundation for the embankment of a reservoir in connexion with the Bleasdale scheme. Public attention is still directed to an extension of the local well system, on the ground of economy, and the final decision of the committee seems as far off as ever.

At the instance of the Duke of Sutherland, Vice-Chancellor Bacon has granted a sequestration of the rates of Newcastle-under-Lyne, but has suspended the action of the order for three months. The dispute is about the fouling of the river Trent by the sewage of the Corporation, and an injunction was applied for by the Duke, and granted in July, 1861.

GAS LEGISLATION IN 1875.

In the last session of Parliament, five non-statutory gas companies obtained Acts of incorporation, with statutory powers. Combined gas and water companies will be noticed further on.

The *Alford Gas Act* dissolves and reincorporates the Alford Gas Company, Limited, established for the purpose of manufacturing gas or inflammable air from coal, peat, oil, &c., and do everything usually done by a gas company. The paid-up share capital of the original company was £5875, which, by this Act, is converted into stock. Power is now given to raise £10,000 additional capital, carrying the usual borrowing power. Gas of 14-candle illuminating power is to be supplied at a price not exceeding 6s. 8d. per 1000 feet. The provisions of the Gas-Works Clauses Act, 1871, apply as regards testing, the place of which is to be within 200 yards of the works. Two hours notice is to be given by the examiner. Interest is to be paid at the rate of 5 per cent. on money received as deposit.

The *Broadstairs Gas Act* dissolves and reincorporates the Broadstairs Gaslight and Coke Company, Limited, who have now a paid-up share capital of £4600, in shares of the nominal value of £5 each, and no mortgage debt. As Lord Redesdale will not allow of shares of a less nominal value than £10 each, the company have power to split the original capital into shares and half shares. This Act authorizes the issue of £6000 additional capital, the dividends on which are limited to 6 per cent. or 7 per cent., according as the shares are preference or ordinary. The company may borrow to the extent of one-sixth of the capital raised, under the usual restrictions. Gas of 14-candle power is to be supplied, at a price not exceeding 5s. 6d. per 1000 feet. With respect to testing, the provisions of the Gas-Works Clauses Act, 1871, are applied.

The *Cleveland Gas Act* incorporates the Cleveland Gas Company, who appear to be the Lofthouse and District Gas Company reconstructed with a new name. The last-named company obtained a Provisional Order last year, and raised £1740 10s. of capital, but did not proceed with their authorized works. The company now incorporated are empowered to raise capital to the amount of £50,000, carrying the usual borrowing power. Gas of 14-candle power is to be supplied, and the price is not to exceed 7s. per 1000 feet.

The *Longwood Gas Act* dissolves and reincorporates the Longwood Gas Company. The original capital is £24,000, most of which is fully paid up. This Act empowers the company to raise additional capital to the amount of £20,000; the dividends are limited to 6 per cent. or 7 per cent. as usual. The company have no mortgage debt, so the usual borrowing power is conferred in respect of both old and new capital. Gas of 14-candle power is to be supplied, and the price is not to exceed 5s. per 1000 feet, with the proviso that, in a portion of the district which impinges on the gas limits of the Corporation of Huddersfield, this company shall charge no higher price than the Corporation. As some of the mains will be carried through parts of the borough of Huddersfield, it is provided that street work shall be done under the superintendence of the borough surveyor.

The *Marlborough Gas Act* incorporates a gas company formed as long ago as the year 1822. They have now a paid-up capital of £7000, and they have expended £1000 and upwards on works out of profits. The original capital of £7000 and £490, representing the £1000 expended out of profits, is to be converted into stock to be divided among the holders of original shares. This Act gives power to raise additional capital to the amount of £22,510, the dividends on which are limited as usual. The usual borrowing powers are conferred in respect of both old and new capital. Gas of 14-candle power is to be supplied at a price not to exceed 7s. per 1000 feet.

In all the above Acts the provisions of the Gas-Works Clauses Act, 1871, with respect to tests of illuminating power, purity, pressure, &c., and also as to interest on money received on deposit are incorporated.

The Acts conferring extended powers on companies already incorporated are as follows:—

The *Bath Gas Act*, which authorizes the Bath Gas Company to raise £70,000 additional capital, but with the conditions that only £50,000 shall be entitled to a 7 per cent. dividend, and the remaining £25,000 to only 5 per cent., the capital being raised in such a manner that the 5 per cent. shall always be in proportion to one-half of the 7 per cent. The gas is to have the illuminating power of 14 candles; but for special reasons assigned in the Act, no penalty is to be incurred unless the power fall below 13½ candles. Five grains of ammonia and thirty grains of "sulphur" are allowed. The former impurity is to be estimated by the referees apparatus, and the latter by the "Letheby" test. The company obtain power to take additional land; but it is enacted that if persons belonging to the labouring class are dispossessed, the company, unless an agreement be come to, shall provide accommodation for such persons.

The *British Gaslight Company (Norwich) Act* empowers the company to expend £80,000 for the extension of the Norwich undertaking. This additional capital is to be entitled to only 7 per cent., or 6 per cent., according as the shares are ordinary or preference. The gas is to have the illuminating power of 14 candles, and is not to contain more than 5 grains of ammonia and 30 grains of "sulphur" per 100 feet.

The *Carmarthen Gas Act* authorizes the company to raise £10,000 additional capital, by the issue of £25 shares, and to borrow to the usual extent, under the ordinary restrictions. The dividends on this new capital are limited, as usual. Gas of 14-candle power is to be supplied, at a price not exceeding 6s. per 1000 feet. Testing apparatus is always to be kept in order, and ready for use. The Act provides that the Corporation of Carmarthen may acquire the undertaking within three years.

The *Cleethorpes Gas Act* empowers the company to raise £10,000 additional capital (the dividends on which are limited as usual), with the customary borrowing powers. Fourteen-candle gas is to be supplied, and the price is not to exceed 6s. 10d. per 1000 feet.

The *Colchester Gas Act* authorizes the company to raise £10,000 additional capital, and to borrow to the usual extent. The capital is to be issued in £20 shares, which are to be sold by auction, with the common provision as to the application of the premiums which may be realized. Several sections of the company's Act of 1866 are repealed, the maximum price for gas is raised to 5s. per 1000 feet, and the charge for lighting, cleaning, &c., public lamps is advanced from 13s. to 15s. Gas of 14-candle power is to be supplied, and in this, as in all the abovementioned Acts, the testing clauses of the Gas-Works Clauses Act, 1871, are incorporated. The burner to be used in testing is in all cases Sugg's New "London," No. 1.

The *Commercial Gas Act* has been noticed before, and its peculiar provisions may again receive notice in another column.

The *Heckmondwike Gas Act* authorizes the company to acquire additional land, and to raise new capital to the amount of £42,000, carrying the usual borrowing powers. The dividends on the new capital are limited in the ordinary way. Gas of 14-candle power is to be supplied, at a price not exceeding that fixed by the Act of 1862.

The *Longton (Stafford) Gas Act* extends the district of the Longton Gas Company, and empowers them to charge higher rates. Whereas, under their Act of 1866, the company could only charge 3s. 6d. per 1000 within the borough of Longton and the radius of a mile from their works, and 4s. beyond, they are, by this Act, empowered to charge 7s. 6d. beyond the radius of a mile. The gas is to have the illuminating power of 14 candles, and is to be tested in accordance with the provisions

of the Gas-Works Clauses Act, 1871. The Act is simply to advance the price of gas in the out-districts of the company, no additional capital being authorized.

The *Newport (Monmouthshire) Gas Act* empowers the company to raise £50,000 additional capital, the dividends on which are limited as usual. The company can also borrow to the usual extent. It is provided by the Act that the directors may, before apportioning dividends, set aside a part of the profits to form a contingency or renewal fund, applicable also to the equalization of dividends; but the amount set apart in any year is never to exceed one per cent. of the capital, and the sum accumulated is not to exceed 2 per cent. of the capital. Fourteen-candle gas is to be supplied, the maximum price remaining the same as fixed by the company's Act, 1855.

The *Tunbridge Wells Gas Act* extends the limits of the company, and empowers them to raise £40,000 additional capital, carrying the usual borrowing powers. The dividends on the new capital are limited to 7 per cent. if ordinary, and 5 per cent. if preference. The price of gas within the limits of the town is not to exceed 5s. per 1000 feet, unless the cost of coal to the company is in excess of 30s. per ton, in which event they may charge another 6d. But before they can do so, the books of the company must be examined by an expert, appointed by two justices, who will certify to the actual cost of the coal. The Act gives the company power to acquire a site for new works.

The *Worthing Gas Act* extends the limits of the company, and authorizes further capital to the amount of £25,000, carrying the usual borrowing power. The dividends are limited to 6 or 7 per cent., according as the capital is issued as preference or ordinary. Gas of 14-candle power is to be supplied, and the price is not to exceed 6s. 6d. per 1000 feet. It is provided, however, that if the coal duty now levied in Worthing shall cease to be levied, or if the company erect works in a district exempt from the duty, the price of gas shall be reduced 3d. per 1000 feet.

(To be continued.)

Correspondence.

SOMERVILLE'S AUTOMATON REGISTER OF ILLUMINATING POWER.

SIR,—Wright's pressure-register, Lowe's jet, and Reid's instrument (but not so perfect) are introduced by John Somerville, and intended by him to record the illuminating value of gas during the range of 24 hours. As the parts of the instrument must be quite familiar to your practical readers, I need not point out that a finely-adjusted balance is useless where the force of a spring is required against it to record its action. May I ask, has your correspondent found out the value of the friction? If so, has he arranged the scale in proportion? And if he has done so, is it reasonable to take it for granted the pencil or instrument used as a recorder will be adjusted so that each adjustment shall be equal to the first? Suppose these difficulties are overcome, the question must arise, what is the standard light value as indicated by Somerville's tried automaton instrument? Is it the height of flame? If so, what pressure? Will a change of pressure act on the flame and on the balance? Will there be an indication of such change on the paper? Will the volume used during such change be recorded in light value on the paper? and will such value be taken on observation? These are questions which must be considered and answered satisfactorily in connexion with the instrument, as noticed in yours of the 30th ult.

The proper course for Mr. Somervile would have been to fix a standard, and upon that base the weight of 1 cubic foot of gas equal in value to the standard. Suppose 500 grains of standard oil to equal 1 foot of gas, standard temperature and pressure, 2·31 grains weight, and equal to so many measures of light. Upon this result form a scale, upon which the balance would act, recording any change of weight on the scale or register. If such a standard cannot be found without falling back upon the aid of standard candle light, by all means allow the photometer, as improved by Hartley, to be the standard, upon which I put the greatest confidence; that confidence being based upon extensive practice on gas valued by weight—Lowe's jet and the photometer. If weight in future has to be the test of quality, I have used an instrument which has been a long time in the market, and which is not yet surpassed for simplicity and truth, the action of which I have compared with the photometer result.

W. L.

APPARATUS FOR EXTRACTING SULPHUR FROM SPENT OXIDE.

SIR,—Having noticed in the president's address to the members of the Southern District Association of Gas Managers, in the JOURNAL of the 16th of November, Mr. Wood's apparatus for extracting the sulphur from spent oxide, by means of bisulphide of carbon, will you allow me to say a few words on the same?

I quite agree with Mr. Wood that it is a very simple process, having often used it for some years, but it is extremely dangerous, without great care, on account of the bisulphide of carbon being a very combustible substance, which evolves dense fumes of sulphurous acid on burning, and is likewise very difficult to put out.

Will Mr. Wood allow me to suggest an improvement on his apparatus? and that is, to place the flask in a bath of boiling water, thus avoiding the risk of using a naked light, to recover the bisulphide of carbon, and to aid and hasten this to pass the fumes through a small horizontal Liebig's condenser; the whole of the apparatus being well corked, as bisulphide of carbon will quickly evaporate in open air. This is the means I use, and find to answer well, as bisulphide of carbon boils at a considerably lower temperature than water.

South Hackney, Nov. 27, 1875. EDWIN ADDENBROOKE.

GAS-EXHAUSTERS AND THE DEPOSIT OF CARBON IN RETORTS.

SIR,—As the subject of gas exhaustion, and the influence exercised by it upon the deposition of carbon in the retorts, has of late had considerable attention paid to it in your paper, I shall feel obliged if you will kindly allow me to make a few remarks upon it.

It appears to me that none of the writers on the subject understand the cause of the deposit, and, of course, until that is known, no correct solution of the difficulty can be arrived at.

I venture to think that with the help of a small instrument I have before me I shall be able to show what is the true cause of the deposit, and also to prove satisfactorily the fallacy of the arguments employed by Mr. Dunlop. I must admit, as another writer has done, that at first sight there is a show of truth in what he says, but as I have had more than one look at the question, the show of truth has vanished.

I must go back to Mr. Dunlop's letter of the 26th of October. He there states in substance that the use of an exhauster does not prevent the deposition of carbon, and that it will not cause increased yield of gas, because the atmosphere is subject to variations; and on one day, when the barometer is at 29·5, you may work without an exhauster, under identically the same conditions as you would on another day with an exhauster when the barometer is at 30·6; but I fail to see the force of the argument, as the very fact of the pressure in the retort being the same on the two days, and the pressure of the atmosphere varying, shows conclusively that the conditions are *not* the same.

Mr. Dunlop appears to have overlooked the fact that the effective pressure within the retort, which influences the deposition of carbon, is that amount by which the whole pressure exceeds the pressure due to the atmosphere, whatever that may be, and his comparison of the Glasgow and Lanark works goes for nothing.

Now, an exhauster is for the purpose of reducing the pressure within the retort to that of the atmosphere, by relieving it of the pressure caused by the apparatus, which is the condition under which the manufacture of gas is carried on most economically; and when I have stated my opinion of the cause of the deposition of carbon, I think it will be seen that an exhauster is a very necessary, as well as useful, apparatus.

Probably most of your readers know what is meant by the dialysis of gases; but I will explain it for the benefit of those who may not be in that position. By dialysis is meant the property which gases possess of separating themselves from each other when brought into contact with certain porous substances, and in that state they are able to pass through the substance. Gases possess this property in different degrees, and it so happens that hydrogen possesses it in a very marked degree, and will pass through porcelain, or substances of a like nature, with astonishing ease. The small instrument mentioned above will illustrate this. It consists of a sort of cup, made of iron, into the top of which is very accurately fitted, so as to exclude the air, a circular plate of porcelain. From the bottom of the cup a small pipe is carried off, and bent upwards to about the height of the top of the cup, the vertical portion being of glass. The cup contains a small quantity of mercury, which, of course, rises to the same height in the tube when the pressure inside and out is the same.

A small plug is affixed to the side of the cup above the level of the mercury, for the admission and emission of air. Now, if this plug is screwed up tight, so that the air within has no communication with the outer air, and a stream of coal gas or carburetted hydrogen is allowed to impinge upon the porcelain plate, the mercury will be observed to rise immediately in the tube to a considerable height (in the apparatus which I have it rises an inch, which is equal to a pressure in the cup of 13 inches of water). This is owing to the hydrogen of the gas passing through the pores of the plate, which increases the elasticity of the air within the cup; the carbon does not possess the same property, and therefore remains behind.

It is in precisely the same way that the carbonaceous deposit inside a retort is formed, the clay being of a similar nature to the porcelain. The hydrogen passes through by virtue of the peculiar property it possesses, and the carbon is deposited.

A slight preponderance of the pressure in the retort over that of the atmosphere facilitates the egress of hydrogen. The exhauster removes this preponderance, and the result is a diminution of the deposit; but it is not so much the removal of the pressure that prevents the deposit as the removal of the gas from the substance which causes the dialysis to occur; and were it possible to fill a retort with gas, and allow it to remain there at the same pressure as the atmosphere, the dialysis would still go on; in fact, it would operate even when opposed by a considerable pressure outside, and were it not for the inevitable cracks in a clay retort, it would be advantageous to work the exhauster at a vacuum.

In speaking of the pressure in the retorts, I have taken no notice of that due to the dip-pipes.

Gas-Works, Northampton, Dec. 3, 1875. JOSEPH TYSOE.

Several communications, already in type, are unavoidably left over till next week.—ED. J.G.L.

DEATH OF MR. W. B. HACK.—We regret to announce the death of Mr. William Boughton Hack, the engineer to the West Middlesex Water-Works Company, which took place at his residence, Hammersmith, on the 8th inst. His connexion with the company dated as far back as 1836, and he succeeded Mr. W. F. Clark as their engineer in 1852. Mr. Hack's health had been failing for some time, but it was only for a few days that he had to keep his bed. He was just turned 69 years of age, having been born on Nov. 22, 1806.

NEW WORTLEY GAS-WORKS.—On Saturday, the 4th inst., the workmen connected with the Leeds Corporation Gas-Works at New Wortley presented to Mrs. Ogden, wife of the superintendent at this station, a handsome gold watch. They had a day or two previously presented Mr. Ogden with a valuable timepiece and a meerschaum pipe, as a mark of respect and esteem, on his retirement from the service of the corporation to take office as engineer to the Blackburn Gas Company.

PRESTON PUBLIC LIGHTING.—The Borough Surveyor (Mr. R. N. Hunter) has issued a tabular statement giving a summary of yearly gas accounts for the public lighting of the borough of Preston from April, 1866, to 1875, inclusive. In the year ended April, 1875, there were 1684 lamps in the borough. The average time that each lamp was lighted was 2869 hours 25 minutes, and the total quantity of gas consumed was 15,542,130 cubic feet, an average of 3·25 cubic feet per hour. The total amount paid to the gas company was £2590 7s.; the cost of gas consumed by each lamp during the year was £1 10s. 9¼d. This shows a decrease of more that 8s. per lamp less than for the year 1866, but about 8¼d. in excess of 1874.

Legal Intelligence.

HIGH COURT OF JUSTICE—CHANCERY DIVISION.

FRIDAY, DEC. 3.

(*Before Vice-Chancellor* HALL.)

THE ATTORNEY-GENERAL *v.* THE HYDE CHEMICAL COMPANY.

Mr. DICKINSON, Q.C., Mr. M'INTYRE, Q.C., and Mr. W. P. BEALE appeared for the plaintiff; Mr. W. PEARSON, Q.C., and Mr. KEKEWICH for the defendants.

This was an information filed at the instance of the Local Board of Hyde, Cheshire, to restrain the defendants, the Hyde Chemical Company, Limited, from carrying on their manufactory in such a manner as to be a nuisance by the discharge of noxious gases, fumes, or vapours, the emanation of smells, and discharge of smoke, and the escape of refuse into the river Tame within the Hyde district, or by other consequences of the accumulation and escape of noxious and offensive products.

The business of the defendants, as described in the information, is that of tar and resin distillers, manufacturing chemists, and oil merchants, also that of makers and sellers of sulphate of ammonia, benzol, naphtha, varnishes, resin, oils, waggon grease, and products of the distillation of gas tar and other substances. The present proceedings were instituted in consequence of complaints made by the inhabitants of Hyde to the local board, of annoyance experienced from the noxious fumes and vapours alleged to be emitted from the defendants works in their manufacturing processes, and from the refuse liquid discharged from the works into the river.

The VICE-CHANCELLOR, in giving judgment, referred to the scientific and other witnesses on behalf of the defendants, that the smells from the works of the company did not constitute a public nuisance, and were not injurious to health, among which was an affidavit deposing that the medical men in the neighbourhood had within the last month sent about 40 children suffering from whooping cough to the manufactory to inhale the fumes of pitch. He said it was contended on their behalf that the manufacture of the defendants was a new one, and that although, when they first began, their machinery was not so perfect as at present, progressive improvements had been continually made, and the business had been carried on without doing harm to any one. They insisted that there was not now, and had not been at any reasonable time before the filing of the information, anything which amounted to public nuisance. This case seemed to him to be a very plain one, and the question which he, sitting as a jury, had to try was, whether or not the informant had established that at or about the time the information was filed the defendants were carrying on their business by means of processes which amounted to a public nuisance. There had been the evidence of many scientific and other witnesses, who had explained the different processes carried on at the defendants works. It was not material to criticize the discrepancies between the evidence of these scientific witnesses, for although, if the questions were treated as scientific ones, then the balance of scientific evidence might be in favour of the defendants, as showing that a nuisance ought not to exist, what his lordship was bound to do was to try the question as a matter of fact by the evidence of persons who had had the opportunity of judging by their own actual sensations and feelings; and against the evidence of such persons it was not sufficient to bring forward other persons who said that such sensations and feelings were not produced in them. There was a great diversity in people's occupations, and some persons might be found who lived to an advanced period of life, apparently in robust health, even though engaged all their lives in what were considered noxious pursuits. These persons were, no doubt, the exceptions, but they were always available when evidence was wanted. It had been sought to attribute the nuisance complained of to other manufactories, but upon the evidence those other manufactories were not chargeable with the offence, and the smells from them were of an entirely different character. The particular noxious smell from the defendants works was that of sulphuretted hydrogen gas—a smell that could not be mistaken for any one of or for all the other smells put together. A number of witnesses had all suffered inconvenience from this particular smell; it had been traced to the defendants works, and the evidence was brought down to the time of the information. Therefore, sitting as a jury, his lordship could not hesitate for a moment in finding a verdict for the plaintiff, and he should accordingly grant an injunction, according to the prayer of the bill, to restrain the defendants from carrying on at their manufactory any of the processes then carried on by them in such a manner as to be a nuisance, and they must pay the costs of the suit.

TUESDAY, DEC. 7.

(*Before Vice-Chancellor* BACON.)

PATTERSON *v.* THE GASLIGHT AND COKE COMPANY.

Mr. KAY, Q.C. (with him Mr. FRY, Q.C., Mr. ASTON, Q.C., and Mr. TREMLETT), in opening the case on the part of the plaintiff, said it involved a very interesting and important question. The suit was a suit by Mr. Patterson against The Gaslight and Coke Company, seeking to restrain their infringement of a patent taken out by Mr. Patterson, which had for its object improvements in the mode of purifying coal gas. Before he troubled the court with the terms of the patent, and with the circumstances of the case, he would endeavour to state the main points involved. There were certain forms of matter in crude coal gas which were called impurities, they being six in number—namely, tar; aqueous vapour, or water; ammonia; sulphuretted hydrogen; sulphur in other forms, the principal of which was sulphide of carbon, but it was referred to continually as sulphur in other forms in the evidence; and the last was carbonic acid. The first three were very easy to get rid of—namely, the tar, the water, and the ammonia. The tar and water were got rid of by cooling and condensing the gas, and washing it with water in vessels which were called condensers; and, for the purpose of the suit, his lordship might dismiss from his mind any further consideration of the two ingredients tar and water. Ammonia also was very easily got rid of. It could be got rid of, because it mixed readily with water; and although ammonia occurred in part of the patent, and part of the evidence which he should have to refer to, he should not have to trouble the court very much with it. Sulphuretted hydrogen existed in gas in considerable quantities, and there had been a long and well-known mode of getting rid of that. The ordinary mode was by treating the gas with oxide of iron, which readily absorbed sulphuretted hydrogen, and separated it from the gas—passing it through purifiers which contained trays of oxide of iron, which absorbed the sulphuretted hydrogen. But the difficulty which the patent, for the first time, surmounted was to get rid of the sulphur in other forms than sulphuretted hydrogen. All the best heads of the great chemists and gas engineers had been long at work on the problem how to get rid of the compounds of sulphur, other than sulphuretted hydrogen, which existed in gas, and until the patent was taken out that difficulty was never solved. The principal of those sulphur compounds was the sulphide of carbon. Carbonic acid existed in gas in very great volumes, and it might be taken that the volume of carbonic acid in the gas, as it issued from the retorts, was three times as great as the volume of sulphuretted hydrogen. No specific means of getting rid of carbonic acid was ever adopted up to the time of the plaintiff's patent. It was not much regarded, and gas, as it was manufactured, contained a certain amount of carbonic acid, although it was proved that it did in some degree diminish the illuminating power of gas. But it was thought that, in the ordinary purification of gas, some of it was taken away, and they did not much care to take away what was left, so that practically the gas, as manufactured and burned, contained a certain amount of carbonic acid. That was the state of things when the plaintiff's patent was taken out. The problem to solve was, how to get rid, in a practical manufacturing way, so as to make it worth while, of those other compounds of sulphur which had proved so obstinate. There were chemical facts known. It was a chemical fact known that other compounds of sulphur would combine with sulphide of calcium, and if sulphide of calcium could be produced pure enough and cheap enough, and the gas could be exposed to its action in such a state as that the sulphur would combine with it, it was known that the problem would be solved, if the gas were submitted in such a condition as that it should take out those sulphur compounds. That was the thing to which a great many minds were addressed, and it was a problem that other inventors had done their best to solve and had failed, so that it never was solved until the plaintiff's patent was taken out. The necessity for solving this problem was an extremely pressing one. In 1860 an Act of Parliament was passed which provided certain persons who were to be appointed for the purpose of fixing an absolute maximum to the amount of sulphur compounds in gas, beyond which gas manufacturers were not allowed to go, except under the penalties imposed by the Act. The maximum, however, was not fixed. Another Act of Parliament was passed in 1868 for the very same purpose, and still the maximum was not fixed, and the reason was that nobody could solve the problem. Until the plaintiff's patent was taken out, the maximum was never fixed. It would be found that the evidence was quite clear that there never was any notion of fixing a maximum up to the very date of the patent, and even beyond it. All the companies rose in arms, and their own statement was that it was impossible the thing could be done; that there was no known process by which the amount of the sulphur compounds could be kept out of gas to the extent it was proposed to impose upon companies by the Legislature. The protests showed, in the clearest possible manner, in addition to the other evidence, what was the state of knowledge, or rather the amount of ignorance, as to the mode of getting rid of these sulphur compounds in gas up to the date of the plaintiff's patent. The process to which he would call attention was the old process used in country districts where gas-works were. There was a difference in what were called urban districts. In places where a good wide space could be obtained, it was possible to use lime, as in country places. In urban localities the use of lime was hardly possible, because it had to be used in large quantities, and when used became exceedingly offensive, and there was great difficulty in getting rid of it. The mode of using lime was, the lime was put into purifiers. In the first place, the gas was submitted, as produced, to the action of a condenser, which cooled it, washed it, and deprived it of the tar, the aqueous vapour, and most, if not all, of the ammonia. Then it was treated either with oxide of iron, which took out of it the sulphuretted hydrogen, and then afterwards with lime; or first with lime, and afterwards with oxide of iron; and there was a doubt which plan was the best. In both modes of treatment the result was that the tar, ammonia, and sulphuretted hydrogen were taken out of the gas. But the other compounds of sulphur were not taken out by either of those modes of treatment, and it was because of this that the Acts of Parliament he had mentioned were passed, in order to put the utmost possible pressure on the gas companies to get rid of those other sulphur compounds. Nor was the carbonic acid fully taken out, and in the gas as used for illuminating purposes there was a residuum of carbonic acid. More than one inventor—certainly one inventor beside the plaintiff—bethought him that if he could make the ordinary materials used in purifying gas available, if he could alter their nature by the very process of purification, and change them so that they themselves should effect the purification of the gas by taking out the sulphur compounds, he would have done the thing all were aiming at in a practical way. They thought they would try, in the ordinary process of purifying gas, to convert the lime, which was ordinarily used, into sulphide of calcium, and that they would then present the gas to the action of sulphide of calcium in such a condition as that the sulphide of calcium would take out other impurities. He should make it a great point of his case that there were running on the same road at least one—the defendants said more, and the more the better for his argument—other inventor, but he did not see his way to doing it. He got very near it. He knew the end to be aimed at. He meant to make sulphide of calcium, and he meant to apply the gas to sulphide of calcium in such a condition that it would remove the other sulphur compounds; but his patent became a dead letter, and the reason of his failure, now that the plaintiff's invention was published, was apparent. He did not understand the mode of making lime into sulphide of calcium, and he did not understand the condition in which the gas itself must be when exposed to the action of sulphide of calcium. But the fact that he was aiming at the same result, and trying to get at the very same thing which the plaintiff had successfully accomplished, showed, as in every case of invention, that the thing to be invented had occurred to other minds, and the man which fairly compassed the problem, the man who practically applied the principles of chemistry, was the man who was entitled by the law of the country and common sense to have his invention protected. He had no doubt he should satisfy the court that the first man who did this was the plaintiff. The plaintiff's patent was dated the 9th of March, 1872, and was sealed on the 28th of May, 1872. He stated that it was for improvements in the purification of coal gas, that the invention related to the purification of coal gas, from sulphur in other forms than sulphuretted hydrogen, by means of sulphide of calcium, while the carbonic acid was likewise reduced, with a corresponding improvement in the illuminating power of the gas. Also that the lime, having been mainly converted into carbon, was much freer from offensive odour. He stated that it was proposed to use a purifier or purifiers containing pure sulphide of calcium, into which the gas was passed after being purified from sulphuretted hydrogen and carbonic acid, and that the condition of the gas when the sulphide of calcium was applied to it was an essential part of the invention. Also that at present the action of lime purifiers was greatly impaired, and sometimes wholly destroyed, owing to the carbonic acid in the gas, whereby the lime was converted into carbonate of lime, which did not absorb sulphur in any form. Accordingly, the plaintiff proposed to eliminate carbonic acid from the gas in such a manner that one or more of the purifiers should contain lime as nearly as might be in the form of sulphide of calcium. Up to this time that had never been practically done, and the reason was, an utter neglect of the action of carbonic acid upon the lime. The evidence on both sides showed that that was undoubtedly the case. It would be found that the simple, ingenious, and beautiful invention of the plaintiff was that if you first took out the carbonic acid from the gas, leaving the sulphuretted hydrogen in it, then the effect of the gas purified from the carbonic acid was to convert the lime into sulphide of calcium. The fact that the carbonic acid must be taken out first was never known, never practically used, before the date of the patent. The provisional specification showed that one mode of applying the principle was by passing the gas through a purifier or purifiers for such time that the carbonic acid should, from its greater affinity for lime, have expelled the sulphuretted hydrogen from the vessel, taking its place, and driving it into the succeeding purifier. By this means the largest possible amount of carbonic acid would be absorbed by the first purifier or purifiers, whilst the sulphuretted hydrogen, being thus driven forward, converted the contents of the subsequent purifiers into sulphide of calcium. After the gas had come from the condenser, if it was then passed through lime for a certain time, you might take from it, by the first action of the lime, its carbonic acid, and let the sulphur compounds go on; the fact being that carbonic acid had a stronger affinity for lime than any of the sulphur compounds. So that if you carefully regulated the time during which the first purifier or purifiers were submitted to the action of the crude gas, you might turn that lime into carbonate of lime simply, and then you would leave the gas with the sulphur impurities in it. Then the further action

of the gas upon lime—that was, the gas freed from carbonic acid—was to convert other fresh lime with which it was brought into contact into sulphide of calcium. That was the operation on the lime of the sulphuretted hydrogen. The essence of the invention, therefore, was that if you first took out of the impure gas (the tar water and ammonia being gone) the carbonic acid, then the sulphuretted hydrogen in the gas would convert fresh slaked lime into sulphide of calcium, and then you got rid of the sulphur impurities by this same sulphide of calcium. The beauty of the invention, therefore, was, by the action of the gas itself to convert fresh slaked lime into that very material which was best of all to take out the other sulphur compounds, which had proved up to the time of the patent, so obstinate that they could not be got rid of. You made the very act of purifying the gas with the known and well-used material, lime, the best mode of producing that sulphide of calcium which would purify the gas of the other sulphur compounds, and you presented the gas to the sulphide of calcium when manufactured, precisely in the state in which the sulphide of calcium would operate to take out the sulphur compounds. This could not be done unless you first of all took out the carbonic acid, and the mode of doing that—the mode of assuring yourself that you did that first—was a thing never thought of or done until the patent was taken out. There were other sulphides besides the sulphide of calcium which had the same effect, and the patent proposed as an alternative mode to use other sulphides, but for the same purpose, and in the same order. The gas must be presented to their action after carbonic acid was out of it. It would be found that, up to the time when the patent was taken out, no one had ever tested for carbonic acid at the issue of the first purifier, or purifiers. The notion of taking it at first had never been brought into practical use at all. If, after the first purifier, or the second, you were only to test for sulphuretted hydrogen, the appearance of sulphuretted hydrogen would not tell you what the condition of the lime had become at all. But if you tested for carbonic acid, you were certain that when that appeared the lime had become carbonate of lime, and the lime had taken up as much carbonic acid as it could possibly hold, if the gas were passed through at a reasonable speed. Up to the date of the patent, he would show by the evidence of the very best men to whom he could refer (and he was sure his friends would not quarrel with the expression, because they were their own witnesses), that the variations in the amount of sulphur in manufactured gas were to them utterly unaccountable. But from the time of the patent being taken out they ceased. It was admitted, in the evidence on both sides, that gas lime in a foul condition—that was, containing a good deal of sulphuretted hydrogen and other things, when exposed to the action of air, the very same thing mentioned in the patent—namely, the superior affinity for carbonic acid with the gas—is exemplified, and the sulphuretted hydrogen is exhaled from the gas lime and becomes a great nuisance. The original bill stated that the plaintiff was the first inventor, and that the invention had never been impeached, and was in full force. It also stated that the defendants were a corporation incorporated by Royal Charter, capable of suing and being sued under that name; that they had six separate gas-works at which the manufacture of gas was carried on—namely, at Beckton (said to be the largest gas-works in the world), Bow Common, Blackfriars, Westminster, Pimlico, and Kensal Green. It also stated that, up to the date of the plaintiff's patent and some time thereafter, the defendant company always experienced great and insuperable difficulty in purifying their gas from sulphur existing in other forms than sulphuretted hydrogen, and that the company and their officers carried out divers experiments to discover a process for purifying their gas from the sulphur so existing; and that, in the course of such experiments, various changes and alterations were made. It also stated that, until the plaintiff's invention, the company were wholly ignorant of any process whereby the gas could be purified, and were unable to control the amount of sulphur in the gas passed through the purifiers. It often happened that the gas, after being passed through the purifiers, was more highly charged with sulphur than before entering. Gas contained carbonic acid, sulphuretted hydrogen, and sulphur in other forms. Pass that gas through lime, and what happened was that the lime took up carbonic acid and sulphuretted hydrogen together at first. By degrees the carbonic acid expelled from the gas the sulphur, which it took up in the form of sulphuretted hydrogen; and it, therefore, might happen, and often did happen that, by expelling the sulphur so taken up, the gas which issued from the purifier actually contained more sulphur in other forms than sulphuretted hydrogen than it did when it went into it. The sulphur which it contained in the form of sulphuretted hydrogen was altered by the action of the purifier and expelled, so as to make the effluent gas more impure than when it went in. The plaintiff said the great difficulty experienced by the defendant company, by want of knowledge of any satisfactory process, was very apparent at Beckton, where the manufacture of gas commenced in 1870. The apparatus was on an unusually extensive scale; nevertheless the result, as regarded sulphur purification, was a complete failure. In consequence of the large amount of sulphur impurity in the gas manufactured by the company at Beckton, the metropolitan gas referees, charged with the duty of prescribing and certifying the maximum amount of impurity in the gas, made during 1871 repeated representations in writing to the defendant company to take steps to effect the purification of their gas from sulphur in other forms than sulphuretted hydrogen, and the company repeatedly expressed their inability to comply with the requisitions of the gas referees. The Corporation of the City of London also wrote to the Board of Trade, complaining of the excessive quantity of sulphur in the gas supplied by the defendant company, and urgently requested the Board of Trade to require the gas referees to fix a maximum. The Metropolitan Board of Works also memorialized the Board to the same effect on several occasions up to February, 1872. Such memorials were forwarded by the Board of Trade to the gas referees, calling their attention to the matter, and stating that they concurred in the opinion that there should be no further delay in fixing some maximum for sulphur in the case of the companies subject to the legislation of 1868 and 1869. The Act made it a punishable offence, except under certain circumstances, if more than 20 grains of sulphur in any form were contained in 100 cubic feet of gas. The plaintiff's patent being dated in March, 1872, it would be seen what change immediately took place at the company's works at Beckton and Bow. In April the average had been 38; in May it dropped to 27; in June it became 14; in July, 12; in August, 10. It would be proved that, beyond all question, the company were using the plaintiff's process. In December, 1872, the plaintiff wrote to them, stating that they were using his invention; saying that he would be glad to grant a licence on reasonable terms; and if they did not enter into such an agreement, they must cease to use his invention. The answer was that the company did not acknowledge the patent rights of the plaintiff; and on April 2, 1873, the bill was filed, asking for an injunction to restrain the infringement of the patent. The answer of the defendants was first a denial that the plaintiff was, either before or at the time of the grant of the letters patent, the true and first inventor of the process which he claimed. Secondly, a denial that no corporation or company, or other person or persons, had, previously to the time of the alleged patent, used the plaintiff's so-called process. Then they stated that the plaintiff was one of the gas referees; that they believed that the plaintiff derived his knowledge of the mode which he pretended to invent from opportunities afforded to him in his official position as to processes employed by the company, and from information supplied to him by persons employed by the company. They also submitted to the court whether it was competent for the plaintiff to make use of the knowledge acquired by him as a public officer in discharge of his duty, for the purpose of taking out a patent. At the time the Beckton works were opened, the state of knowledge was such, that it was thought a good result might be obtained by passing the gas first through oxide of iron and then through lime. Oxide of iron did not take from the gas its carbonic acid; but it did take from the gas the sulphuretted hydrogen, so that the gas when it issued from the oxide of iron purifiers would have lost the sulphuretted hydrogen, by which alone could lime be turned into sulphide of calcium, but it would not have lost the carbonic acid, by which the lime would be turned into carbonate of lime; so that when the Beckton works were opened, and until the gas referees compelled them to make the change, such was the state of knowledge on the subject of purifying gas that they used the oxide of iron and lime in such order as made it impossible for them to avail themselves of the sulphide of calcium, and made it certain that the lime would be converted into nothing but carbonate of lime—a perfectly inert substance. The answer said it was found that the use of oxide of iron before the lime did not give satisfactory results, and that the gas, as issued from the purifiers, was insufficient to purify it from sulphur, therefore it was intended to use lime before oxide. This showed the absolute ignorance of engineers at that time. The answer further said that certain alterations were required in the purifiers, and in the beginning of August, 1871, the company began to use the lime purifier before the oxide of iron purifiers, in a manner similar to, but not exactly the same as that employed at the Bow Common works. It was not, however, till the 12th of May, 1872, that the machinery for purifying the gas was completed by the addition of certain check purifiers. For about a fortnight the result of the method of using the lime before oxide of iron were eminently satisfactory, and the quantity of sulphur in the gas very considerably diminished. After that time the defendants said it was found that the proportion of sulphur increased, notwithstanding all the efforts made to reduce it, until at last the gas was found to contain as large a proportion of sulphur as before the introduction of the new method. That meant that they altered the order, and put the lime purifier first, and found, after a time, that the thing got as bad as ever. The reason was, they left the last purifier so long that not only the sulphuretted hydrogen, but everything else, went over. The answer went on to say that a series of experiments were tried, in order to discover the cause of the failure of the method then in use, and the best means of remedying it; and the manager from time to time communicated the results of his experiments to the gas referees, including the plaintiff. The manager, in the result, was led to believe that the true cause of the failure of the lime purifiers was partly the presence in the crude gas of an unusually large quantity of carbonic acid, and partly the fact of the gas entering the purifier at too high a temperature. The principal object aimed at at the Beckton works was to produce gas of a high illuminating power without the use of cannel coal. With this view, Mr. Evans, the principal engineer, proposed to dispense with the use of condensers, and the object aimed at was attained. But, on the other hand, it was found that the gas entered the scrubbers at too high a temperature, and the sulphur compounds were driven forward, and the high temperature of the gas prevented the formation of sulphide of calcium. Mr. Evans also, it was said, tried a system of purification at Beckton successfully; but owing to the immense quantity of gas manufactured there, the whole of which had to be passed through two purifying-houses, it was found impossible to continue that system. This was in October, 1871, and the amount of purifying area at that time was greater than at any other known works. On the 23rd of October Mr. Trewby said he charged the first purifier with lime, and took precautions by frequently going out and recharging the purifiers in the first and second set to keep the lime in the third set in a state of sulphide of calcium. But that the result was anything like that which had been the consequence of the use of the plaintiff's patent was completely disproved. It was said the patent was anticipated by Trewby's experiments. But no test was applied to see whether the carbonic acid was being taken out. Then it was said that on the 18th of February, 1872, Mr. Trewby commenced working a modification of the system adopted by him in October, 1871—namely, to work the first two purifiers in the first and second sets respectively for carbonic acid. So that his modification of the preceding plan was now for the first time to try and get the carbonic acid out first. Mr. Trewby said he threw them out of work as soon as they showed carbonic acid, and recharged them. Then he must have tested for carbonic acid. But it would be seen whether he did. After May, 1872, Mr. Trewby dropped the use of oxide of iron to take out the sulphur compounds, and used lime in the condition of sulphide of calcium, which he said was the present plan at the Beckton works. That was a distinct admission that the company were using the process described in the patent. Then the answer stated the Bow process since November, 1867. The gas on leaving the mains passed through condensers, where the tar and vapour and water were deposited in a liquid form by the cooling action of the atmosphere. From the condensers it passed through scrubbers; from the scrubbers it passed through two purifiers, each charged with originally clean slaked lime. But there was no care taken to prevent carbonic acid passing the first purifier, and coming into the other. No test for carbonic acid coming out was applied at all, and, therefore, it was no anticipation of the patent. The marvellous thing was that, whereas the average impurity at Bow was about 22 or 23 grains per 100 feet of gas before the patent, it was now reduced to 8 or 10 since the date of the patent.

WEDNESDAY, DEC. 8.

Mr. KAY resumed his argument, and said a new point was raised by way of a criticism upon the specification—namely, that there was no novelty whatever, at the date of the letters patent, in the employment of sulphide of calcium as a means of purifying coal gas, which formed the first head of the plaintiff's patent. Then it was said that the plaintiff had not described any new mode for the application of sulphide of calcium to that purpose, or stated in what manner the process should be performed. It was said the second head of the plaintiff's invention appeared to consist in a statement of certain well-known chemical facts, and in certain practical suggestions to gas manufacturers. Independently of the question of novelty, it was insisted that the second head of invention was not a proper subject of a patent, that there was no novelty in the apparatus for detecting the presence of carbonic acid issuing from the purifiers. Then that the processes employed at Beckton, for a year or thereabouts, after the works were opened, were necessarily of an experimental character, and, no doubt nearly up to the date of the plaintiff's patent, the company admitted they were experiencing great difficulty in purifying the gas from sulphur in other forms than sulphuretted hydrogen. Then they said that their officers and engineers had carried out divers experiments, chiefly at Beckton, to discover a process to purify the gas from the sulphur existing therein, and various changes were made in charging the purifiers. Then the defendants denied that, notwithstanding such endeavours, they were wholly ignorant of a process whereby gas could be sufficiently purified, but they admitted that they were, until the purifying works were completed, unable to control the amount of impurity in the gas manufactured at the Beckton works, which had been passed through the purifiers. Then the defendants said it was untrue, or calculated to give a false impression, to speak of the difficulties experienced in the purifying of gas as arising from a want of knowledge of any satisfactory process for the purpose. The Beckton works were designed by Mr. Evans, their chief engineer, and the apparatus for purifying the gas was intended to be, and was, on an unusually extensive scale. They admitted the complaints of sulphur by the City of London and the Board of Trade. Then they spoke of the maximum having been fixed in the last week of March, 1872, at 30 grains per 100 cubic feet; and they stated their belief that, in and after the month of March, 1872, some diminution in the sulphur complained of took place, chiefly at Beckton, but they denied it was in consequence of

the report of the referees. The diminution commenced on the 20th of March, 1872. Then they said they believed the official returns of the various amounts of sulphur per 100 feet of gas were correctly set forth in the bill, and again denied that the reductions in the amount of sulphur, though later in date than the referees report, were due to any information which the company or their officers derived from that report. They then said that they had not obtained the plaintiff's leave or licence, but denied that they had infringed the letters patent purported to have been granted to the plaintiff, saying that they were not validly granted, and that they intended to continue the use of the process. Further, they said that by the user of the processes described they had been enabled to reduce the amount of sulphur in the gas below the maximum fixed by the gas referees, and they believed the average cost of purification of gas per 1000 cubic feet had been, at Beckton, from October, 1871, to April, 1872, ·89 of a penny, and from April, 1872, to October, 1872, ·94 of a penny. The defendants further answer stated that in the early part of February, 1872, they had not succeeded in keeping down the amount of sulphur in the gas manufactured at Beckton, or been able altogether to control the fluctuations which were occasionally considerable in the amount of impurity occurring from day to day, but that no practical difficulty had been experienced on this head except at Beckton. They also stated that the properties of sulphide of calcium were well known, and it had been used in the purification of gas before the date of the patent; and a reference was made to a patent granted to a Mr. Mann. They admitted that the chemical effect of carbonic acid upon foul lime was and is the principal obstacle to the use of lime in towns and populous places. The system of lime purification in use at Bow Common, they said, did not differ in principle or substance from the system in use at the various gas-works in London, and that it was based upon the practical recognition of the effect of carbonic acid to expel and drive forward the sulphuretted hydrogen from the lime. The defendants also said that the mode of working in February, 1872, which the plaintiff alleged was an infringement of his patent, was suggested to Mr. Trewby by the plaintiff's letter of the 15th of February, 1872, and they submitted that that letter was a publication of the plaintiff's invention. The points raised by the answers on the specification itself were that there was no novelty in the employment of sulphide of calcium as a means of purifying coal gas from sulphur compounds existing in other forms than sulphuretted hydrogen, which formed the first head of the plaintiff's patent. Then there was a denial that the second head of the invention had any novelty in it, and the third, fourth, and fifth were passed lightly over. The plaintiff had evidence about them quite sufficient. The defendants insisted that the invention was anticipated by Trewby at the Beckton works in August, 1871; or, if not then, in October, 1871; or, if not then, on the 18th of February, 1872; or, if not then, in May, 1872. How anything done in May, 1872, could be an anticipation of a patent taken out in March, 1872, he (the learned counsel) did not understand. The defendants said that at the Bow works they were using a process which was not the plaintiff's. They admitted that at Beckton they were using the plaintiff's process, by testing after the first purifier for carbonic acid; that was insuring that the first purifier took out all the carbonic acid, and then subjecting the gas, with the carbonic acid taken out of it, to the action of fresh slaked lime, which it converted into sulphide of calcium, and that took out the other sulphur compounds. This, it was alleged, was no infringement of the patent, because the patent was invalid. Those were the only points raised by the answer, except that it was said Mann's patent was an anticipation. He (the learned counsel) would show what the actual state of knowledge was up to the very day when the patent was taken out from documents which were admitted; and that the plaintiff's invention was novel, ingenious, and useful. The material thing in the patent was the condition of the gas when it was submitted to the action of sulphide of calcium. The patentee stated it was necessary to employ sulphide of calcium in a separate purifier, to make the lime into sulphide of calcium by the action of the gas after the carbonic acid was taken out of the gas. It might be said (and he would anticipate the objection) that the claim of the patentee was the use of sulphide of calcium generally. But the patent was framed upon an authority which had decided that such a claim did not mean the general employment of sulphide of calcium, but the employment in the manner described in the invention. The patentee said: "Having told you my invention and the mode of applying one of the things I claim as original, that is, the mode of using the sulphide of calcium in purifying gas from the sulphur compounds which I claim." Upon this point, the learned counsel referred to the cases of *Arnold v. Bradley*, 6th Chancery Appeals, p. 706; *Beard v. Egerton*, 8th Common Bench, p. 168; *Kay v. Marshall*, 1st Milne and Craig, p. 382; *Howath v. Hardcastle*, 1st Webster's Reports, p. 485. He thought those authorities would satisfy his lordship that the office of a claim was not to enlarge or describe the invention, but to restrict it to that which was considered to be the novel part of it; and that the mode of construing a patent was to read it as a whole. There was no case whatever in which a general claim had been held to invalidate a patent. Although the claim, if it stood alone, would be too large to be the subject of a patent, it must be read with reference to what was described in the anterior part of the specification. An important case to refer to was *Hills v. The London Gaslight Company*, 5th Hurlstone and Norman, p. 312. That case showed that, although a chemical fact were thoroughly well known, the man who practically applied that to a useful purpose to which it had never been applied before, or in a mode in which it had never been practically applied before, had a right to have a patent for that application. That was the position of the plaintiff in the present case.

The VICE-CHANCELLOR said: The learned baron in that case drew a distinction between the principle and the means or methods.

Mr. KAY replied that the learned judge said the question was not properly stated; but it was established beyond doubt that the application of any known principle in creation, to a particular chemical result was a perfectly good subject of a patent. He submitted that the claim confined the patent accurately to the particular manner described, of employing sulphide of calcium, which was novel, because up to the time of the patent it had never been brought into practical operation that sulphide of calcium should be applied to coal gas, after the carbonic acid and the sulphuretted hydrogen had been taken out of the gas. The second claim was said not to be a proper subject of a patent—namely, the mode or system of employing lime purifiers in the manner described. The plaintiff stated his manner of employing lime purifiers so as to convert the contents into sulphide of calcium. Sulphide of calcium was produced by the sulphuretted hydrogen in impure gas being turned into fresh lime; but in order to produce sulphide of calcium you must first have got rid of the carbonic acid, which had a greater affinity for the lime, and turned it into carbonate of lime. Under the old process carbonate of lime was produced. That was precisely the mistake in Mann's patent. There the object of the inventor was to produce sulphide of calcium to purify gas; but the patent became a dead letter simply because he did not understand that you could not produce sulphide of calcium by the action of foul gas, till you had taken out of the gas the carbonic acid. He would not dwell upon the other parts of the patent, because there was no distinct denial concerning them, and there was ample evidence to prove that they were new and useful. Then as to the facts proved in answer to the other points raised by the defence—namely, the alleged anticipation, and the statement that the patent was not new and useful—he would show first of all what the state of knowledge on the subject of gas purification was, and particularly as to getting rid of sulphur compounds other than sulphuretted hydrogen, down to, and at the date of, the patent; secondly, that the alleged anticipations were not anticipations at all, but entirely missed the point which the plaintiff for the first time discovered; thirdly, that Mr. Mann's patent was not any anticipation; fourthly, that the letter of the plaintiff of the 15th of February was not a publication of his invention. In 1860 an Act of Parliament was passed, called the Metropolis Gas Act, 23 & 24 Vict., cap. 125. The 25th section of that Act fixed the illuminating power of the gas at 12 sperm candles, and stated that the gas should not contain more than 20 grains of sulphur in any form in 100 cubic feet of gas. Then there were penalties for exceeding the amount agreed upon, or, in the absence of agreement, the maximum. In 1867 the Bow works were in existence. In 1868 the City of London Gas Act was passed. Section 29 of that Act said the Board of Trade should, as soon as possible after the passing of the Act, appoint three competent and impartial persons, one at least having practical knowledge and experience in the manufacture and supply of gas, who should be called gas referees. Their duties were to test the gas for its illuminating power and purity, amongst other things; and by section 36 the gas referees were, from time to time, to ascertain with what degree of purity each company could reasonably be required to make and supply gas continuously, without causing a nuisance in the neighbourhood of the works, and thereupon to prescribe and certify a maximum amount of impurity in each form with which gas supplied by the company should be allowed to be charged, regard being had to the necessity for alterations of the works. The gas companies were to give the referees all facilities for investigating the matter. But there was no provision in that Act saying that the referees were bound in any way to tell the companies what they were to do, or to invent processes for them, or anything of that sort. In point of fact, the gas referees were inspectors who were to test the gas as manufactured and issued to the consumer, and to investigate in every way the mode of manufacture. Their principal duty was, as soon as might be, to fix a maximum to the amount of sulphur impurity which was to be allowed in gas. On the 1st of September, 1868, the plaintiff was appointed by the Board of Trade one of the gas referees. His colleagues were Mr. Evans, the gas engineer of the defendants, now a director of the company, and Mr. Pierce. The plaintiff's qualifications for the office were that he had been educated for the profession of a civil engineer, he had attended the chemistry classes of Dr. Reed in Edinburgh, and in 1867 had published a pamphlet on the gas and water supply of London. He had both chemical and engineering knowledge. Mr. Evans did not remain long one of the gas referees. He resigned his office in May, 1870. In a report made by Mr. Harris, dated the 1st of September, 1869, it would be found what was the state of knowledge at that time. Mr. Harris was the manager of the Bow works. From October, 1864, to December, 1865, Mr. Harris stated that the whole of the coals used were picked over by men and boys, and every possible piece of pyrites was picked out. Pyrites was supposed to have something to do with the impurity, but he said the effect did not warrant the expenditure. Those were experiments for the removal of sulphur compounds other than sulphuretted hydrogen. From November, 1864, to June, 1865, some gas was experimented upon by passing it through a preparation of soda and lead, and the result showed a diminution of about half the sulphur compounds; but the difficulty of the operation prevented it being used upon any extended scale. In January, 1865, slaked lime was mixed with the coals in the retort, but very little good was effected. From February to April, 1865, the gas was treated first experimentally, and afterwards largely, by passing it through red-hot tubes in conjunction with steam. Experimentally, nearly the whole of the sulphur compounds were removed, but when in practical operation it was not successful. In 1865 various things were tried in the manufacture, such as shortening charges, reducing the carbonizing temperature, and so on, but no result of importance was produced. In July, 1865, gas was washed with tar, but without success. In October, 1865, soda waste was used, and the result was not good, because the carbonic acid completely destroyed the effect of it. Then tar and pitch were used in the purifiers without success. During the last three months of 1866, certain other experiments were tried; and during the latter part of 1866, experiments with dry lime in various ways were tried, passing the gas through lime first, and afterwards through oxide of iron, which removed about 40 per cent. of the sulphur compounds. This was put into practical operation in January, 1867, and it was said it had been continued until the present time. So that the defendants found experimentally that if they put lime before oxide of iron, the result was obtained of diminishing the sulphur compounds about 40 per cent.; but they never tried by taking out the carbonic acid, and they said they had never altered what was done at Bow. Forty per cent. of the sulphur compounds, which was 40 volumes out of 100 volumes, were taken out by the process, and 60 per cent. were left in, so that the result was that 60 per cent. of the sulphur compounds still remained in the gas. Mr. Harris, in his affidavit said, that the mode of working lime purifiers which had been in use at Bow Common ever since the 16th of November, 1867, was identical with one of the processes claimed by the plaintiff. Instead of testing for carbonic acid, as mentioned by the plaintiff's patent, he said he had always tested, and still tested, for sulphur compounds, other than sulphuretted hydrogen. But he did not test for carbonic acid, and therefore there was an end of that anticipation. Then, to pursue that order of date, he (the learned counsel) would read a letter written by the referees to the Board of Trade on the 31st of December, 1869. In that letter Mr. Evans joined, he being one of the referees, and the engineer to the defendant company, who designed the Beckton works. In that letter it was stated, "as regards the sulphur impurity, no practical process has hitherto been discovered, by which all the elements of this impurity can be removed, indeed, it is still uncertain in what form this impurity exists in gas." A table was given, showing the actual daily fluctuations from 37 grains per 100 feet to 16·78 in the Central; in the City, from 22 to 14·3; in Arundel Street, from 27 to 13·8; and in Leadenhall Street, from 26 to 14. The material thing was that the referees, of whom Mr. Evans was one, excuse themselves from fixing a maximum for sulphur impurities upon the ground that no practical process was yet discovered for removing all the sulphur impurities. On the 30th of May, 1870, there was a meeting of the officers of the various gas companies with regard to this difficult question. At that meeting there were present Messrs. Harris, Mann, Upward, Livesey, Kirkham, and Clark, together with all the referees. Mr. Harris, when examined as a witness, said that if they were confined to 30 grains of sulphur, they would not know what to do; and, in his opinion, the companies would not be safe if the maximum were fixed at 50 grains. In July, 1870, the new works of which Mr. Harris was manager were taken by the defendant company from the Great Central Gas Company, and it was in that month that the referees first report on sulphur purification was laid before Parliament. In November or December, 1870, the manufacture of gas was commenced by the defendant company at Beckton, and he had pointed out to his lordship that so little was known about the scientific mode of getting rid of the sulphur impurities, that they actually began at these works by putting oxide of iron purifiers before lime purifiers. Consequently that constituent which would turn lime into sulphide of calcium was taken out in the first instance, and the carbonic acid was left, which would turn the lime into carbonate of lime. That was a most ignorant mode of setting large new works in operation, as was now proved. They took out the sulphuretted hydrogen first, thereby depriving the gas of its most important constituent to get rid of the other sulphur compounds, and not depriving it of the carbonic acid. That was continued until August in the next year. The purifiers at Beckton were circular vessels, made of strong boiler-plate; they were set in a room, the floor coming to about the middle of them, so that the floor clasped them outside, and in these were put rigid trays, about 4 in. each, at equal intervals in the height of the purifiers. These trays were pierced with holes, and upon the trays was put about 6

inches of the material which was being for the time used in purifying the gas, whether it was lime, sulphide of calcium, or oxide of iron. So that supposing you wanted to use the oxide of iron first, then you loaded the trays with oxide of iron, and gas came in and rose through the trays; and, in passing through, the purifying action of the material upon the trays was exercised on the gas. Of course the passage of gas through any material to some extent checked the progress of the gas, and if it was too much checked you could not get it out of the retorts, which would injure the make of gas. That was called the back pressure. On Dec. 8, 1870, there came a complaint from the Corporation of London of the amount of sulphur in the gas. At that time the Beckton works were not begun, according to the defendant's statement, and therefore it was chiefly the gas from Bow and the other works. On the 16th of May, 1871, the Board of Works complained to the Board of Trade of the same thing—namely, the amount of sulphur in the gas of the defendant company. On the 2nd of June, 1871, a report was sent by the Board of Trade to Mr. Phillips, the secretary, from the referees, calling attention to the great increase which had taken place in the amount of impurity of the gas at Beckton, and saying that the referees required urgent attention to the matter. It also said that in the opinion of the referees it was desirable that the present arrangement of the Beckton purifiers should be changed, so as to place the lime before the oxide, as that process gave at Bow twice as good results as were obtained at Beckton, unless some better process could be devised by the company's engineers. At this time the condition of the sulphur impurity at Beckton works was given in a table prepared by the gas referees, showing the average of sulphur for June and July, 1871. It was, for June, 43·9 Beckton, 34·2 Blackfriars, 27·7 Westminster. July, 42·5 Beckton, 36·4 Blackfriars, 34·3 Westminster. The average of the two months was given as 43·2 Beckton, 35·3 Blackfriars, 31 Westminster, being all considerably above the standard. Mr. Phillips, the secretary, wrote a letter stating that the directors were most anxious to reconcile the discrepancies which appeared to exist, and had given directions to change the order of the oxide and lime. On the 11th of July, 1871, the referees again wrote to say they regretted to have again to call attention to the excessive amount of sulphur in the gas manufactured at Beckton, and that they required that the gas made at Beckton should be quite as clean of sulphur as at Bow. Beckton being near where the sewage of London flowed into the Thames, there could be, he (the learned counsel) thought, no hesitation in doing everything that was needed, whether by the use of lime or otherwise, to remove the sulphur impurities. On the 15th of July, a patent was taken out by Mr. Evans for improvements in the purification of illuminating gas, but it was not pretended that that patent in the least degree hit upon the scheme patented by the plaintiff, or that it was successful. Everybody knew that the desideratum was to get rid of the sulphur impurities, and in the very thick of the difficulty, Mr. Evans, one of the referees, took out a patent, but his patent did not solve, or affect to solve, the difficulty. On the 29th of July the referees wrote again to Mr. Trewby, who was the practical manager of the Beckton works, stating their regret to learn that alterations had not yet been made in the purifiers, nor in the employment of lime before the oxide, as recommended, and they begged that the work might be done immediately. Mr. Trewby wrote, in answer, on the 31st, saying that the delay in setting the purifiers to work had arisen from causes over which he had no control. August was the date of one of Mr. Trewby's anticipations of the patent; but not by his own genius had he arrived at the conclusion that the lime ought to come before the oxide, because the suggestion came from the referees. There was a statement that in August, 1871, no pains were taken to remove carbonic acid, but that on the 18th of February, 1872, quite a new plan was commenced, which was to remove the carbonic acid first. That was never done till that date, and that he would prove. It was the very essence of the plaintiff's plan that you should take out the carbonic acid first, or you could not produce a proper gas at all. He would call his lordship's attention to a letter from Mr. Trewby, superintendent of the works at Beckton, to Dr. Letheby, in which it was shown that they had reduced the impurities in their gas by various means. They had, for instance, passed gas through lime, and by that means reduced the amount of sulphur, and were in hope of reducing it still more. They had also tried ammonia, but that had not had any good effect. Looking at all the evidence, it was clear the new plan, which Trewby was going to put in operation, was not put in operation in August or in October, 1871, because he spoke of his plan as being new, for the first time, in February, 1872. The only change effected in the working in 1871 was to put (at the request of the referees) the lime before the oxide of iron. There was no recognition at that time of the effect that carbonic acid had upon the lime, and of the impossibility of making sulphide of calcium without first getting rid of the carbonic acid. That recognition did not take place till February, 1872. The process which was adopted at that time was (according to Mr. Trewby's own statement) the same as used at Bow, and as generally practised. Was the plaintiff's patent generally practised, or was it used at all at Bow at that time? He had shown that it was not. That was enough to dispose of the question; but he would not leave it there. He would take next Mr. Evans's account. Mr. Evans stated that soon after the opening of the works at Beckton, the experiment was tried of passing the gas through purifiers charged with oxide of iron and lime. It was found that oxide of iron before the lime was not satisfactory, and it was determined to use lime, more extensively, before the oxide of iron. For that purpose the purifiers were altered, and in the beginning of August, 1871, the defendant company first began to use the lime purifiers before the oxide of iron purifiers, in a manner similar to that employed at the Bow Common works; but it was not till the year 1872 that the machinery was completed. The same story as was told by Mr. Evans was told by Mr. Trewby. According to his account, shortly after the works were opened at Beckton, experiments were tried. The gas was passed through purifiers of oxide of iron and then lime. Afterwards it was determined to use lime more extensively, and for that purpose it was necessary to fit up the purifiers with four trays of sieves instead of one. They were completed in July, 1871, and in August they began to use the lime purifiers before the oxide of iron purifiers, as they did at Bow, the only difference being that the lime used at Beckton was more slaked than that used at Bow, and at Beckton they had a larger number of purifiers. Nothing is said of a test for carbonic acid. No attempt was made to take that out. There was no recognition of the fact that, without first taking out the carbonic acid, you could not produce a good result. The only change made was to put the lime purifiers before the oxide of iron purifiers. They stated that the result of that change was satisfactory, for the quantity of sulphur in the gas was diminished. That did not last, however, for it was found that the proportion of sulphur began again to increase, till at last the gas was found to contain as large a proportion of sulphur as before the introduction of the new method. That showed that they knew nothing of the plaintiff's process. A series of experiments was then resorted to to discover the cause, and the results were from time to time communicated by the company to the gas referees, and they were ultimately led to believe that the cause of the failure arose, partly from the presence in the crude gas of an unusually large quantity of carbonic acid, and partly from the fact of the gas entering the purifiers at too high a temperature. It would now be seen whether that discovery was made by the defendant company or by the plaintiff. There was a letter of the 31st of August from the referees to Mr. Evans, calling attention to the fact of an increase of sulphur in the gas, which confirmed what Mr. Trewby had stated to be the result of the experiments he had made. In reply, Mr. Evans said they were doing all they could to remedy the defect, and diminish the quantity of sulphur in the gas. Therefore, his lordship might take it as proven that all they could do had been done, and that what was done was mainly to reverse the order of the purifiers. Mr. Trewby also wrote, on Sept. 1, 1871, to the referees, saying that all that could be done had been done, and he could not account for the fluctuation in the gas. The reason was plain—the carbonic acid was not taken out, and the lime became all carbonate of lime; that was, it was rendered perfectly inert, and the gas passed through it as it would through so much sand, without being in the least degree purified. His lordship would find that on the 20th of September the referees wrote again, complaining of the state of the gas. On the 23rd Mr. Trewby answered that letter, telling the referees that he had done all in his power to keep down the amount of sulphur. He said he had for a whole week done all his purification by lime, but without the desired effect. Could there be a greater state of ignorance than that? All sorts of experiments had been tried. Oxide of iron was tried before lime, then the oxide of iron was dropped altogether and lime alone tried, and still with no better result; but the lime being left for a long time, was changed into carbonate of lime; not one particle of the bisulphide, that was the sulphur compound other than sulphuretted hydrogen was taken out of the gas; but there was just as much after it had passed through the lime as before it went in. As a last resort Mr. Trewby had resolved on using lime from the same place as that from which Bow Common was supplied, to see if that would have the desired effect. He thought there was something wrong with his lime. A more complete illustration of the defendants ignorance could not possibly be given. He had now brought the matter down to Sept. 23, 1871. At that date, after trying the use of lime before oxide of iron, then oxide of iron before the lime, then lime alone without any oxide, assisted as they were by great chemists, and subject to the pressure put upon them by the referees, with the fact staring them in the face that a maximum would be fixed, subject to heavy penalties if not complied with, they yet were utterly unable to find out the cause of their confessed failure, and were driven at last to suppose that the fault lay in the lime. They, therefore, proposed to try the Bow lime, to see if that would answer better. There was no suggestion whatever to the effect that the failure might be caused by omitting to remove the carbonic acid from the gas before it was exposed to the action of lime. There was, therefore, nothing up to the 23rd of September, 1871, which showed that the defendant company had anticipated the patent of the plaintiff. The next point raised by the defendant company was that, if the patent was not anticipated in September, 1871, it was in October of that year. It ought to be stated that the plaintiff, who at that date was one of the referees, had himself suggested the placing of the lime purifiers before the oxide of iron purifiers, and also a new mode of charging the lime purifiers, by fitting them with four trays instead of one only. Those alterations, it was clear from the evidence, came into operation about the second week in August, 1871. It was also a fact that, if gas was kept in the purifiers for too long a time, the carbonic acid in the gas began to expel the sulphuretted hydrogen, and converted the lime into the inert form of carbonate. And at that time the gas was kept for 12 days in the lime purifiers. The effect was, in two days they became saturated with acid impurities, so that the contents of the vessels were converted into carbonate of lime, whereby, notwithstanding the unusual number of vessels used, the purifiers entirely failed in their action; and, as was shown by the official tests, that continued until May, 1872. By that means the lime became completely inert in two days, and for 10 days the gas was passing, with all its impurities, through the lime just as if it had been so much sand. That confirmed conclusively what Trewby had said that, notwithstanding all that had been done, the gas was as bad as ever. No attempt was made at that date to see what was done with the carbonic acid. Then it was stated that, at least in October, 1871, a change was made, which was certainly in anticipation of the plaintiff's patent. It was alleged that at that date Trewby, by frequently throwing out and recharging the purifiers in the first and second set, kept the purifier in the third set, which had been substituted for one of the oxide of iron purifiers, in a state of sulphide of calcium. As to that, he would first take what the plaintiff said in his affidavit—that on the 23rd of October an extra purifier, being No. 1 in the third set, was charged with lime instead of oxide of iron. The process was described by Mr. Trewby also in a letter which he had written to the referees, and he there stated that No. 1 purifier was charged with lime in the third set, so that the two streams of gas, after passing the first and second sets of lime, went through an additional lime vessel. But throughout that letter nothing was said about the lime of that purifier of the third set being in a state of sulphide of calcium. The only change made was that, instead of using eight purifiers with lime and four with oxide of iron, nine purifiers were charged with lime and three with oxide of iron. That was done only in one of the purifying-houses, and was soon afterwards abandoned, in consequence of the immense amount of gas and the consequent back pressure. There is nothing throughout the whole of the evidence which goes to show that on the 23rd of October anything had been done in anticipation of the plaintiff's patent. The statement that Trewby at that time took precautions by frequently throwing out and recharging the purifiers in the first and second sets in No. 1 house, so as to keep the purifier in the third set in a state of sulphide of calcium, was untrue. The plaintiff declared, from his personal inspection of the works, that that was true. The records of the Beckton works also showed that at the period referred to, between the 23rd of October and the 19th of November, 1871, each purifier in house No. 2 was recharged, on the average, every 270 hours, and each purifier in house No. 1 was recharged in 276 hours; so that, instead of changing them frequently, the same lime was kept in each of them—in the one house 270 hours, and in the other house 276 hours. The gas manufactured in both houses was also equally impure at that date, which would most certainly not have been the case if the plaintiff's patent had been anticipated. The plaintiff also declared that he knew from personal knowledge that no testings of carbonic acid were made at Beckton at that date. Mr. Trewby's records of the purification at that place proved that no process similar or resembling the plaintiff's was at that time employed. The figures set out in the table, taken from the records of the works at Beckton, showed that. The learned counsel reminded his lordship that, as the charge was worked at Beckton in 48 hours, the lime would become saturated and be changed into carbonate of lime, and would be quite inert and useless. Now, it was a fact that Mr. Trewby himself admitted, that on the 19th of November he dropped the process which he began on the 23rd of October. All he did was to take an additional lime purifier instead of one of oxide of iron. He divided the gas after it left the condensers and scrubbers into two streams, one through house No. 1 and another through house No. 2; in each house he had two sets of purifiers. Those two sets he had filled with lime, and they passed them through a third set, which was oxide of iron. There were four purifiers of oxide of iron, and for one of those he substituted a purifier of lime. The story told by the defendants was that Mr. Trewby took precautions by constantly recharging the first sets of lime purifiers, Nos. 1 and 2, to keep the new lime purifier in a state of sulphide of calcium. That would be shown to be untrue. Did Mr. Trewby at that time change the lime purifiers in the first and second sets sufficiently frequently to keep the new lime purifier in the third set in a state of sulphide of calcium—that was, did he take any kind of precaution to see that no carbonic acid was coming over from the first and second sets of purifiers? It would be shown he did not. In fact, the longer matters went on, the worse they became. It was certain that, from Oct. 23 to Nov. 16, in 1871, in the very house in which the new system was introduced, the average result was 33·88, or nearly 34 grains per 100 cubic feet of sulphur impurities, and that went on all through that time till the system was abandoned in November. What was the difference made by the system of Mr. Trewby in the house where it was used, from that in the house where it was not used? One grain per 100 cubic feet. That was all. That was the only difference made by that

process which it was alleged was in anticipation of the plaintiff's process. What was it that made Mr. Trewby's efforts fail? They failed, not because sufficient lime was not used—there was plenty; they failed because the earlier vessels of the series were not recharged as often as they should have been. Now, with the light of the plaintiff's invention before them, the defendants declared in their answer that which, if it had been true, would have been some ground for their saying we anticipated your process. If they had changed the lime in the early purifiers of the set sufficiently often to keep carbonic acid from going further, they would have done that which the plaintiff has done. Another point was, how long were these purifiers in fact kept at work, and was it true that they were changed with sufficient rapidity to ensure the absorption of the carbonic acid? Copies of records of the books at Beckton, supplied to the gas referees, showed that except the use of one more vessel with lime, no change was made in the mode of purification, and the lime in both the houses was worked in the same manner, and the allegation that the process was such an one as to be an anticipation of the plaintiff's patent was altogether untrue. According to those records, purifier No. 2 was at work 249 hours; clean for 20 hours; foul for 229 hours. That is equal to 9 days 17 hours. So for 9 days 17 hours that No. 2 purifier was kept in a state in which it could not absorb any carbonic acid at all, but allowed it to pass on to the new purifiers. It was kept at work 9 days 17 hours after it became foul. Then purifier No. 4 was kept at work 261 hours, it was clean 15 hours, and foul 10 days and 3 hours. Another time it was worked for 221 hours, clean 33 hours, foul for 7 days and 20 hours. Another time worked for 288 hours, clean 46 hours, foul 10 days and 2 hours. Another time worked for 284 hours, clean 44 hours, foul 10 days. So that the average was they were at work 10⅛ days, clean 31¾ hours, foul 9½ days. That was a complete answer to the suggestion that they were so often changed as to ensure the new purifier being kept in a state of sulphide of calcium. Those facts related to the first house, and the facts were the same as to the other. That all confirmed the evidence of the defendants as to the charge acting well for a time, and then the gas becoming as bad as ever. On the 19th of November it was given up altogether. The change which the defendants managed to effect was very slight indeed, just such a change as you would expect would occur from using a larger quantity of lime in the ignorant manner in which it was used, without taking any sort of precaution to get the carbonic acid out of the gas first. Those facts, therefore, quite disposed of the story told in the answer, that the first and second sets of purifiers were so often changed, or rather the lime in them, as to ensure the new purifier being at that time, when first filled with lime, in a state of sulphide of calcium. That allegation was entirely refuted by those facts. Yet the defendants persisted in declaring that Mr. Trewby charged the first set with lime, and took precautions, by frequently throwing out and recharging the purifiers in the first and second sets, to keep the purifier in the third set in a state of sulphide of calcium. That they did nothing of the sort was perfectly clear. The facts were as stated by the plaintiff, and as proven by the tables. Not only were no precautions taken, as is alleged to have been done by the defendants, but no other precautions, such as testing for carbonic acid, were employed; and, in fact, the purifiers in both houses were worked in precisely the same way, and the lime purifier in the third set in house No. 1 was, instead of being kept in a state of sulphide of calcium, treated as the other purifiers. The plaintiff says that as soon as lime becomes foul, it gives up the sulphide of hydrogen. In 31 hours, plus one-third, the lime would be carbonate of lime, simply because the sulphide of hydrogen would be expended. Therefore you may confidently take it that in 42 hours the lime would be converted into carbonate of lime, and would be perfectly inert like sand—perfectly useless for any purposes of gas purification. That was actually what had occurred in that case. Not only for 42 hours, but for nine days after the gas was in that state, was it permitted to flow over into the purifier, which Mr. Trewby said he kept in the state of sulphide of calcium. It would perhaps be as well, before leaving the point, to show his lordship what Mr. Trewby himself had said. He had stated that he charged the purifiers with lime, and allowed them to get into a state of sulphide of calcium. When the lime was removed, it was of a dark green colour, which showed it contained scarcely a trace of carbonate of lime. The pressure, however, was very great, and the system was therefore not adopted in house No. 2, and in house No. 1 was abandoned. The first purifier was then charged with oxide of iron. He would take his stand there upon that statement. Supposing Mr. Trewby had been making the very experiments which the plaintiff succeeded in making practical afterwards, beginning them on the 23rd of October, and abandoning them on the 19th of November, would that abandonment have been an anticipation of the plaintiff's patent? That was, however, the fact, that whatever the experiments were, they were given up and abandoned on the 19th of November, and were not reduced to any practical issue, and were never thought of as being capable of any use whatever. That was not all. Mr. Trewby never did, in the least degree, take any precaution for the purpose of transmuting any of this lime into the condition of sulphide of calcium. Did he test for carbonic acid? His answer showed he did not. For he declared that there was no necessity to test for carbonic acid in the first and second sets. He has said that when he took the record of the working of the purifiers to the referees, he pointed out to them the benefit that was gained by this purifier; and the plaintiff (then one of the referees) seeing the importance of it, asked Mr. Trewby why he did not continue the working of it. Mr. Trewby replied that his make of gas would not admit of it? The results obtained from the working of the purifier convinced Mr. Trewby, according to his own account, that when the check purifiers were finished, and his make less, he would be able to keep the sulphur down. That matter was afterwards discussed, and the plaintiff told Mr. Trewby that he could not make his statistics to tally. And the plaintiff, commenting upon the very tables which had been read to his lordship, showed that the lime was kept, after it had become carbonate of lime, for nine days; a result which would, of course, make it quite impossible to make sulphide of calcium in the newly filled purifier. Going back to paragraph 16 of the defendant's evidence, he would show that the document which he produced contained a true record of the working of the purifiers, and the amount of sulphur issuing from each between October and November. That was the document from which the tables were taken, and there was no difference between them. It was worthy of observation that Mr. Trewby, in his affidavit, did not confirm that paragraph, he did not say that he changed the lime so often as to produce sulphide of calcium in the new purifier, or that he did it for that purpose. That, then, overcame the second difficulty, that, as alleged by the defendants, there was at least an anticipation of the patent of the plaintiff during October and November, 1871. All that was done was to put in, in perfect ignorance of the principle involved in the plaintiff's patent, which was the vital importance of extracting the carbonic acid from the gas before you could make sulphide of calcium—all that was done was to do that which he had already laid several times before his lordship, and which had no effect whatever in doing that which was desired. There were only one or two other professed anticipations, and he would deal very shortly with them. First of all there was the alleged anticipation of the patent by Mr. Trewby. He said, or at least his answer said, that even if the above anticipations could be shown not to be anticipations, he had most certainly anticipated the patent on the 18th of February, 1872. Now it would be remembered that Mann's patent was taken out on the 2nd of December. That was a cardinal matter in the case, as showing what the knowledge was, and confirmed what had been shown from other sources was really the state of knowledge of all these great gas engineers on the subject at that time. The plaintiff continued to visit the works down to the middle of December, 1871. He did not seem to have gone again till July, 1872. On the 21st of December was written that letter which had been referred to, as to the alteration in October, 1871. It was a letter from Trewby, in the course of which he said that he had returned an account of the experiments on the sulphur question. Then, on the 20th of January, 1872, a circular was sent, Mr. Trewby says, to himself and others, including Mr. Harris. That, of course, was the circular sent by the gas referees. It should be stated that they had a laboratory of their own, where Mr. Patterson was making experiments, doing the best he could to find what it was that had baffled all the engineers. On the 25th of January, 1872, he had nearly completed his own experiments, and he then determined to take out a patent. It was then that the circular was sent round, saying that if the person to whom it was sent had made any testing in carbonic acid at the inlet of a purifier, or any prior stage, the referees would be obliged if he would communicate the result. That was sent to Mr. Harris, to Messrs. Mann and Brothers, and to Mr. Trewby. No immediate reply was received by the referees, and another letter was written and sent round, in which they said that, as the matter was of great urgency, the referees would be obliged if they would send them what they had asked for in their former circular. That was the substance of the letter. Mann, Harris, and Trewby were in connexion with the defendant company. Mr. Mann wrote back (he was the man who had taken out a patent), and said, in the course of it, that he had never tested for carbonic acid. Was, therefore, the state of knowledge at that time such that Mr. Mann, who had taken out a patent, had never tested for carbonic acid? Very well, then, it was perfectly clear that he did not understand the necessity of getting rid of carbonic acid. The manager at the Horseferry Road works, Westminster, wrote saying that he had never made any test for carbonic acid at the inlet of his purifiers. What did they do at Bow, where Mr. Harris was? Why, in answer to the letters of the referees, Mr. Harris sent word saying that he had given instructions for the analysis for carbonic acid, and would send them the results when he had obtained them. It evidently had not occurred to Mr. Harris, before that time, to test for carbonic acid. Mr. Harris wrote another letter, saying that he was continuing the examinations, both before and after the scrubbers. Therefore, it was certain he had never before this time examined for carbonic acid both before and after the scrubbers. Therefore, that fact was clear—that Mr. Patterson, the plaintiff, wanting to know what the state of carbonic acid was, obtained these answers from men who knew as much about gas as any one at that time. Another person, a Mr. Horatio, Brothers, also stated that they were aware of the fact of carbonic acid in gas when burning, but they had made no definite testings. That is what they said to the referees. January 20, 1872, was the date when those circulars and letters were sent round to those individuals, and those were the answers received, some of them not being sent until the 2nd of March. It was at this time that there was a complaint made from the Board of Works to the Board of Trade as to the amount of sulphur in the gas supplied to them. On the 5th of February, 1872, they complained again. So that with all those inventions which Mr. Trewby seemed to think he had made, he could not have made any appreciable change in the gas, as was proved by the Metropolitan Board of Works sending such a memorial to the Board of Trade. The Board of Trade sent that memorial to the gas referees, accompanied by a letter, in which they call the attention of the gas referees to the subject, and declare that they fully concur in the opinion expressed by the Metropolitan Board of Works, that there should be no further delay in the fixing of a maximum for sulphur, and saying that Parliament, in placing three large gas companies under more stringent regulations, could never have contemplated a maximum of sulphur not being fixed. It was proved that at this very time Mr. Patterson, the plaintiff, had completed his laboratory experiments, and had ascertained the condition of things in the various gas-works. No man, in fact, knew better than he what the amount of knowledge was at that time, and he had determined to patent his invention. On the 15th of February, 1872, Mr. Patterson, the plaintiff, wrote to Mr. Trewby, and it would be found that that was the first written or printed document of the plaintiff's invention. The occasion of that letter being written was that the plaintiff having satisfied himself by experiments in the laboratory of the value of his invention, wanted to know how it would work in the manufactory; and he wrote Mr. Trewby a letter as to the purifying of lime further than it had been, and suggesting his own mode of doing it. The letter showed that nothing which he there suggested had been done before. He suggested to Mr. Trewby an experiment, and said what he would like Mr. Trewby to do. He might now say that he had read every document down to that date touching the question of sulphur impurities, and he would ask whether the thing Mr. Patterson, the plaintiff, begged Mr. Trewby to try was ever hinted at before? He would say that it was not. It would be seen how everybody's eyes became open at once—in a moment. Four days after having received that letter on the 18th of February, 1872—three days after receiving that letter, Mr. Trewby said he tried a new process, which he declared was his own invention, and which he also said was in anticipation of the plaintiff's patent. He would take the first answer, pages 6 and 7. On the 18th of February, 1872, it was said Mr. Trewby commenced a modification of the system partially adopted by him in October, 1871. Did he do so? Nothing of the kind. He was then doing what the plaintiff suggested for him to do. That was all. Mr. Trewby said what he was then doing was an anticipation of the plaintiff's patent. He said he was working the first two purifiers in the first and second sets respectively for carbonic acid, and retaining the third purifier in a state of sulphide of calcium. He also said there that he tested for carbonic acid at the outlet of the scrubbers. But that he never did till after he had received the letter from the plaintiff. Mr. Trewby said that was the system that had been used ever since, and described the works at Beckton. So that it was evident, when Mr. Trewby had satisfied himself of the good of the plaintiff's process, he put up two additional purifiers, and called them by a name up to that time quite unknown—"carbonate purifiers"—and worked them by testing every hour at the outlet of these purifiers for carbonic acid. It might be well to give one more paragraph from Mr. Trewby's affidavit, paragraph 28, as to the result. He there said, after working the purifiers in the way described, and finding that no improvement was effected, on the 29th of February he put a small purifier to work and reduced the impurities. That led him to watch narrowly the purifiers; as they came out he kept on reducing the sulphur, and found there was some deficient action in the purifiers, and found the purifiers had got distorted, and the gas passed by them. So that, so far from this experiment, suggested by Mr. Patterson, and tried by Trewby, being a success, he found it a failure, and he said, not that the suggestion was a bad one or the process a good one, but that his machinery had got out of order; but in laboratory experiments, which extended to the 14th and 20th of March, he found it was quite successful. It was unlucky for Mr. Trewby that the plaintiff's patent was taken out on the 9th of March, before Mr. Trewby had satisfied himself that the experiment could succeed. It never had before occurred to Mr. Trewby to do that which was suggested by Mr. Patterson. The first human being who ever tried it was Mr. Trewby, and he did it on the 18th of February, experimentally, at the request of Mr. Patterson. That was plain from the dates. He said it failed; but in laboratory experiments it succeeded. The plaintiff's patent was, however, taken out on the 9th of March, and something else had transpired before that. It might be taken as fact that Mr Patterson did not visit the Beckton works from December, 1871, to July, 1872, and he had, therefore, no direct knowledge of the change made by Mr. Trewby, and no communication was made to the plaintiff of the adoption of any new process in the method of purification, and he did not hear of it till after the commencement of this suit. Taking the date of the 19th of February, the day after that new process was

adopted, there was a letter from Mr. Phillips, the secretary of the defendant company, to Dr. Odling. In that letter the defendants speak of the uneasiness which the returns made by the official testers of the sulphur impurities were causing the directors, which was increased by the fact that all their efforts to effect an alteration had been baffled. Dr. Odling was also asked to visit the Beckton works, in order to give the company the benefit of his advice. In his reply, Dr. Odling said that the amount of trustworthy knowledge on the subject was very small. It was admitted by all now, that the plaintiff's process was a perfect one, and that by it sulphur impurities could be reduced to an extent which had never been done before. That was being done at the Beckton works by the plaintiff's process. There was at those works now no incidental variation, no accidental raising of the amount of sulphur impurity; it was kept down within defined limits, and they did not now confine themselves to keeping down to the maximum, but brought it down considerably lower than the maximum which was at that time imposed. In consequence of that, the maximum had been reduced, and the maximum allowed in gas since the working of that process had become known, was infinitely lower than everybody thought was possible, until the invention of that process. A similar letter was written by Mr. Phillips to Dr. Letheby, a man of the very highest authority in such matters, and Dr. Letheby said he would be very willing to do anything towards the better manufacture of gas. Another letter was written, and Dr. Letheby went down. Before those visits were made, it should be mentioned that Mr. Trewby told Mr. Phillips that his attention had been given to the subject of sulphur purification, and that he had made all kinds of experiments. For the first time he mentioned, in connexion with those experiments, the experiments as to carbonic acid, and said he had kept certain purifiers for the purpose of taking the carbonic acid only, and the remainder for the sulphur; and that was on the 18th of February, three days after receiving Mr. Patterson's letter, asking him to try it as an experiment. Down to the 15th of February, 1872, the date of Mr. Patterson's letter, it is a fact that there is no document of any kind in which that subject is hinted at Down to that date Mr. Trewby applied all his skill to solve the problem, and failed; but on February the 18th he begins to talk of purifying his gas in some new manner. What was that new manner, if not the process suggested by Mr. Patterson, the plaintiff? Mr. Trewby admits that he did that for the first time on the 18th of February; and Mr. Phillips, writing to Dr. Odling and Dr. Letheby, begged them to go down to the works, as they were uneasy at the state in which they were. When they did go, the new process was explained to them, and they saw separate purifiers being worked for carbonic acid, and the gas coming off was tested, and their attention called to it. Dr. Odling visited Beckton on two occasions, on the 24th of February and on the 28th of March, and saw the new process. The altered manner of working was described in the evidence, and it was found by that that Mr. Trewby had not even yet succeeded in getting at the full secret. His manner of working did not succeed, and on the 8th of March, according to his own admission, he had a conversation with Mr. Patterson as to sulphide of calcium. Yet he said he had invented, on the 25th of February, a process by which all that he desired could be done. That could not be true, because it was proved that he had doubts in his own mind, even about that time, as to the effect of sulphide of calcium as a purifier of gas from sulphur impurities. It was evident that he was not acquainted with the matter. The date of the plaintiff's patent was the 9th of March, and gave him the rights of a patentee for 14 years from that date. On the 11th of March he showed it to Mr. Phillips, and on that day Dr. Letheby visited the Beckton works. Carbonic acid was then being tested. Dr. Letheby made his report, and said in it that a process was going on by which lime was kept too long exposed to the action of foul gas, directed attention to many very important matters, and recommended that the purifiers should be worked for a much less time than they were then being worked. He suggested that they should only be worked 24 hours.

At this stage the court rose, and the case was adjourned until Friday.

THURSDAY, DEC. 9.

(*Before Vice-Chancellor* MALINS.)

Re THE EUPION FUEL AND GAS COMPANY.

This case was expected to come on as a motion to-day, and

Serjeant BALLANTINE, instructed to cross-examine the witnesses, told his lordship that, in consultation the previous evening with Mr. Higgins, it had been thought desirable not to bring on the motion in its present form, but to classify the contributories so as to have representative cases, otherwise the case would be interminable.

Mr. HIGGINS, Q.C.: Upon the present summons a dozen different cases would have to be gone into at great length.

The VICE-CHANCELLOR said he understood a call had been made which the contributories denied their liability to.

Mr. GLASSE, Q.C., said he was prepared to support the summons in its present form.

The VICE-CHANCELLOR said he was afraid, from what he knew of the matter, it would be very long.

Mr. HIGGINS replied that no doubt it would be.

The VICE-CHANCELLOR said he was not in a position to take any new long matter before Christmas.

Serjeant BALLANTINE suggested that a trial was pending which would involve some of the questions raised in the summons.

The VICE-CHANCELLOR said he understood there would be a criminal trial, and it would be better that that should take place before he entered into the question, because in the criminal trial the parties would have the advantage of a jury. He should, therefore, order the summons to stand over until the Hilary sittings. In the meantime, probably the parties would agree to classify the cases.

The matter stood over accordingly.

MANCHESTER WINTER ASSIZES.—SATURDAY, NOV. 27.

(*Before Justice* LUSH.)

FRAUDS BY THE SUPERINTENDENT OF THE BOLTON CORPORATION WATER-WORKS.

John Wrigley was charged with embezzling £404 2s. 2½d., the property of the Corporation of Bolton. He was further charged with falsifying entries, and with destroying books and accounts with intent to defraud; also with embezzling another sum of £83 17s. 9d.

Mr. POPE, Q.C., and Mr. LERESCHE appeared for the prosecution; the prisoner was defended by Mr. CHARLES RUSSELL, Q.C., and Mr. ADDISON. He had been in the employment of the Corporation of Bolton during a period of 22 years, commencing as a clerk with a salary of £80 per annum, finally becoming superintendent of the water-works department as a salary of £240 per annum. Under the terms of the employment as superintendent he was to pay into the bank every two months the moneys coming into his hands, or whenever the sum collected by him exceeded £50.

Evidence was given that between the 1st of June and the 28th of July, 1874, the amount passing into the hands of the prisoner was £5934 2s. 2½d., arising from water-rents and payments for fittings. During that period he only paid into the bank £5530, leaving a balance of £404 2s. 2½d. unaccounted for. On the 29th, 30th, and 31st of July, 1874, the receipts amounted to £826 14s. 2½d., the prisoner making a payment into the bank of £742 16s. 2d. on the 1st of August, no moneys having been paid in on the three previous days, showing a deficiency of £83 17s. 9½d., of which no payment or account was given. On the books being examined by an accountant, serious deficiencies were found during the four previous years, amounting to £5451. After the 1st of August, when the prisoner left the office, the counterfoil receipts exactly corresponded with the sums paid into the bank. The books, which were under the immediate control of the prisoner, had in part disappeared at the time of his apprehension, and evidence was called to prove that he was seen destroying account books in a furnace near his office in the town-hall, Bolton, and that a portion of them, from which leaves had been torn out, was found subsequently concealed under the flooring of his office.

For the prisoner it was urged that there had been great laxity in the mode of keeping and auditing the books of the corporation, and it was suggested that the discrepancies on his part might have arisen by mistake.

The jury, however, returned a verdict of "Guilty," and the prisoner was sentenced to five years penal servitude.

WESTMINSTER POLICE COURT.—THURSDAY, DEC. 9.

(*Before Mr.* ARNOLD.)

PROCEEDINGS UNDER THE COMPANIES CLAUSES ACT TO COMMIT FOR NON-PAYMENT OF GAS-RENT.

Mrs. *M. A. Clements*, residing in Ovington Street, was summoned by the London Gaslight Company for neglecting to pay the sum of £5 7s. for gas supplied to her, and for the hire of a meter.

The amount was not disputed, but Mr. SMYTH, who appeared for the defendant, asked that, under the circumstances, his client should not be committed.

Mr. ARNOLD said he was bound to make the order.

Mr. SMYTH said he undoubtedly was, but not to put it in force. For the purposes of this case, the magistrate was in the position of a county court judge or superior court judge; and he hoped he would exercise a power similar to that vested in them, and not commit the defendant without proof of means. His client, having got into pecuniary difficulties, borrowed £15 from a loan office. Of this, £5 was deducted for interest, and she signed a paper, which turned out to be a bill of sale. Under that bill they had seized goods worth more than £100. She was in an empty house, and had only the things she stood upright in.

Mr. ARNOLD said he should make the order, and if the company wanted it enforced, they must apply for a summons to show cause why she should not be committed. If it was proved that she had no means, he should, exercising the power of a county court judge, refrain from committing her.

SATURDAY, DEC. 11.

Mr. *Edmund Buckland*, of 158, Bridge Road, Batterses, was summoned by the London Gaslight Company to show cause why he should not be committed to prison in default of paying the sum of £9 0s. 9d., ordered to be paid under a summons at this court for gas consumed at 323, Fulham Road.

In the case reported above, Mr. Arnold had expressed his intention not to make orders of commitment against persons who had not means of payment, thereby acting in the discretion vested in county and superior court judges, and especially referring to the new Masters and Servants Act, which prescribed the same form of procedure in police courts as that used in county courts for the recovery of these debts.

The *defendant*, having been sworn, said he was a commission agent and earned barely a pound a week. He had no other means of satisfying the debt.

Mr. A. DOVE, who appeared for the company, urged that the powers vested in a county court judge did not appertain to gas companies in the police courts. They had an Act of Parliament which enacted that in default of distress the magistrate should (not might) commit, and therefore he had no alternative, and with regard to the *quasi* county court jurisdiction, the Abolition of Imprisonment for Debt Act, 1869, exempted orders made by magistrates, and the Companies Clauses Consolidated Act, 1845, s. 149, prescribed the form of procedure and commitment for any period not exceeding three months in default of payment, or distress.

Mr. ARNOLD was satisfied, on the evidence of the defendant, that he could not pay, but at the same time the 149th clause of the Act of 1845 rendered a commitment imperative; he, therefore, ordered the defendant to be imprisoned for one day.

Defendant was locked up till five o'clock, and then discharged.

Miscellaneous News.

METROPOLIS GAS SUPPLY.

METROPOLITAN BOARD OF WORKS.

At the Meeting of the Board on Friday last, Dec. 10—Sir J. HOGG, M.P., in the chair,

The Parliamentary Committee presented the following report:—

Your committee have to report that they have proceeded on the resolution of the Board of the 26 ult. (No. 21), referring to them for consideration the scheme for the amalgamation of the Imperial and Independent Gas Companies with The Gaslight and Coke Company, and the letters from the Board of Trade on the subject. Your committee have also considered the letter from the vestry of Shoreditch, referred to them on Friday last, asking the Board to oppose the amalgamation. It is hardly necessary to point out that this question is one of considerable importance at the present juncture, when the Corporation of London and the Board are about again to lay before Parliament the bill relating to the Metropolitan Gas Companies, the consideration of which occupied so much time last session; and it is desirable to look into the present scheme a little closely, and to ascertain its probable effect as regards the interests of the gas consumers. This is the more needful, as it has been for some time past tolerably clear that the amalgamations which have already taken place since the passing of the City of London Gas Act, 1868, whatever their advantages may have been to the companies and their shareholders, have been productive of anything but advantage to the consumers of the gas of the smaller companies, whose undertakings have been incorporated with that of The Gaslight and Coke Company.

In justification of this statement it may be well to produce a few facts relating to previous amalgamations, showing what their effect has been upon the price paid for gas in the districts of the incorporated companies.

On Jan. 1, 1870, the undertaking of the Great Central Gas Consumers Company was amalgamated with that of The Gaslight and Coke Company, under the provisions of the Act of 1868. During the year 1869, both companies charged for gas 4s. per 1000 cubic feet. The Great Central Company, with this price, earned considerably more than was necessary to pay its 10 per cent. dividend; as much more, indeed, as was represented by 7d. per 1000 feet of gas sold, so that the company could have paid its maximum dividend with a price of 3s. 5d. per 1000 feet. The Gaslight and Coke (Chartered) Company, on the other hand, did not, in the year 1869, make sufficient profit to pay its authorized dividend; an increased price to the extent of 5d. per 1000 feet would have been necessary to enable it to divide 10 per cent. Had it not been for the amalgamation, therefore, the Great Central Company must, in the year 1870, have reduced its price to at least 3s. 6d. per 1000 feet; and in the years 1873 and 1874, when the high prices prevailed, it would certainly have been in as good a position as its neighbouring companies—the Independent, the Ratcliff, and the Commercial—which in those years were charging for their gas at the rates of 3s. 6d., 3s. 9d., and 4s. per 1000 feet respectively, whilst, in consequence of the amalgamation referred to, the consumers in the district which formerly belonged to the Great Central Company, and which comprised about one-third of the City of London, had the price raised in 1873 to 4s. 4d., and in 1874 to 5s. per 1000 feet.

On July 1, 1871, the undertaking of the Equitable Gas Company was amalgamated with that of The Gaslight and Coke Company. In the year previous to the amalgamation the earnings of the Equitable Company represented a sum equal to 4·82d. per 1000 cubic feet of gas sold more than was necessary for the 10 per cent. dividend. Therefore, as the company was charging 3s. 9d. per 1000 feet, it could have paid its full dividend with a price of little over 3s. 4d. The Gaslight and Coke Company was then charging 3s. 9d., but, notwithstanding the benefit derived from having amalgamated with itself the Great Central Company, it did not earn sufficient to pay its maximum dividend by 2·61d. per 1000 feet. A 10 per cent. dividend would have required a price of 3s. 11½d. per 1000 feet.

Looking now to the result of the amalgamation as it affected the consumers of the Equitable Company, it will be seen that this was anything but advantageous. At a general meeting of the shareholders of the company, held on Nov. 1, 1870, the year prior

to amalgamation, the proceedings of which are to be found reported in the JOURNAL OF GAS LIGHTING of the 8th of November of the same year, Sir James Duke, the chairman of the company, is reported to have spoken as follows:—"With reference to our own company, I venture to say, without any disparagement to our neighbours, that there is no company in the City of London or elsewhere which is in a better condition in every respect. Our works are in first-rate order, and no pains are spared to maintain their efficiency in every respect, and I have no hesitation in affirming that both our management and economy, as shown by our report, are such as justify the fullest satisfaction on the part of the proprietors. I am happy on this occasion to give you the best possible proof of the ability and efficiency with which our works are conducted, by making the announcement that on the 1st of January next we intend to give the public the benefit of a further reduction in the price of gas. We also hope, at the same time, to be able to increase the illuminating power of the gas, and to maintain its quality as to purity."

It need hardly be said that, amalgamation having been agreed upon almost immediately after this statement, and before the next general meeting was held, the promise of the chairman of the Equitable Company was not fulfilled, and no reduction of price took place. The company's reserve-fund and accumulations, amounting to £29,776, were carried to the insurance-fund of The Gaslight and Coke Company, and in the years 1873 and 1874 the consumers were charged 4s. 4d. and 5s. per 1000 cubic feet for common gas. Such was the result of amalgamation to the consumers in the Equitable Company's district.

On July 1, 1872, The Gaslight and Coke Company, pursuing its policy of amalgamation, took over the undertaking of the Western Gas Company. This Company, which supplied only cannel gas—that is to say, gas of 20-candle power—was able to do so at the price of 5s. per 1000 feet, and to make its maximum dividend. On its incorporation with the larger company, a balance of £33,042 was carried over to the dividend account of the latter; but for which The Gaslight and Coke Company would not have been able to pay its maximum dividend.

The consequence of the amalgamation to the consumers in the Western Company's district was, that instead of continuing to benefit by the prosperous condition of their own company, they were subject to the high prices of The Gaslight and Coke Company, which were at the rate of 4s. 4d. and 5s. per 1000 feet for common gas during the years 1873 and 1874, the price charged for cannel gas during the last-mentioned year having been 6s. 3d.

Notwithstanding these and other amalgamations, which brought into The Gaslight and Coke Company additional rentals, amounting in the aggregate to £444,000, the company's profits in the first half of the present year fell short of what was necessary to pay the maximum dividends by £38,000; therefore another prosperous undertaking, that of the Independent Company, is to be now absorbed.

Let the position of the gas consumers, living in the Independent Company's district, be compared with that of the consumers supplied by The Gaslight and Coke Company, as regards the price which they have been called upon to pay during the last six years, and the comparison will be as follows:—

	The Gaslight and Coke Company.	*The Independent Gas Company.*
1869	4s. 0d. per 1000 cubic feet.	3s. 4d. per 1000 cubic feet.
1870	3 9 „ „	3 4 „ „
1871	3 9 „ „	3 3 „ „
1872	3 9 „ „	3 2 „ „
1873	4 4 „ „	3 4 „ „
1874	5 0 „ „	3 6 „ „

The Independent Company is now charging 3s. 6d. per 1000 cubic feet, and the effect of the amalgamation will be to at once raise the price to 3s. 9d. The shareholders of the company, having a flourishing business to dispose of, are to have a preference dividend; whilst the consumers, who are at present supplied by a company which can and does serve them well and cheaply, are to be handed over to another company which will at once call upon them for a higher price to enable it to secure the shareholders dividends.

There is this further advantage in the transaction, when seen from the point of view of the absorbing company, which helps to explain the eagerness for amalgamation which it has for years past shown, that not only will the profits of the Independent Company go to make up the deficiencies of The Gaslight and Coke Company, but the latter will have the satisfaction of obliterating another of those examples of good and economical management which contrast so favourably with its own, and which constitute a standing reproach to it. For it must be remembered that The Gaslight and Coke Company possess in some respects advantages greater than belong to any other company. It boasts of being the largest in the world, and containing, as its district does, the City of London and its surroundings, it has the greatest supply in proportion to area, and therefore, one would naturally suppose, the most profitable supply in the metropolis; yet there are companies with widely spread districts, and other disadvantages, which have for years been setting it an example which it appears incompetent to follow. These examples reminding them continually, as they can hardly fail to do, of their own extravagant management and other defects, must, in the opinion of the directors of The Gaslight and Coke Company, be made to disappear. Preference dividends for the shareholders, compensation for the directors, pensions to the officers of the amalgamated undertakings—these and similar inducements must be resorted to, that the individuality of the small and well-managed companies may be destroyed. So long as they exist they are a standing accusation of extravagance and bad management against the Chartered Company, and accordingly no pains are spared to amalgamate them out of existence.

Your committee have thought the present a fitting opportunity to place before the Board a view of the results of the amalgamation which have been effected by The Gaslight and Coke Company since the passing of the Act of 1868, and they will now refer to the scheme of amalgamation which is the immediate subject of this report.

The scheme is put forward under the powers of The Gaslight and Coke Company's Act, 1871 (section 56), which enables that company to amalgamate with itself any other gas companies in the metropolis by means of a scheme to be submitted to the Board of Trade, and confirmed by an Order in Council.

The general effect of this scheme will be to bring the whole of the districts supplied by the three companies under the conditions which attach to The Gaslight and Coke Company by virtue of the City of London Gas Act of 1868; and the main question which presents itself is, whether the provisions of the Metropolis Gas Bill of last year, and especially the provision relating to the sliding scale of price and dividend, shall be applied to the united company. If this be not done, your committee do not hesitate to express the opinion that the effect of the amalgamation upon the consumers of gas living in the Independent Company's district, and the effect upon the conditions of the metropolitan gas supply generally, of absorbing this well-managed company, which, with one or two others, has been of essential service as a standard of comparison, will be such as to justify the Board in offering strong opposition to the scheme. At the same time it is to be borne in mind that the adoption of these provisions does not remove all objections to an amalgamation between companies whose conditions are not equal. The object of the bill is to place all the companies under uniform regulations, but not to secure one uniform price. The consumers of a district now supplied upon better terms than would result from amalgamation are justified in resisting amalgamation, and it is the duty of this Board to protect their interests to the best of its ability. It is but one-sided justice to guarantee to the shareholders of the Independent Company a dividend of 10 per cent. under all circumstances, and to leave to the consumers who have been sharers, so to speak, in the company's prosperity, the certainty of having in future to pay a higher price for their gas. If the shareholders of this prosperous company are to have special advantages secured to them on account of its prosperity, why should not the consumers have some advantage also? These considerations, and the expediency of maintaining some means of comparison as to the prudence and care exercised in the management of gas undertakings, make it more than doubtful whether, even if the provisions of the bill of last session be adopted, the amalgamation is one that should be agreed to in the interest of the public at large. Your committee are glad, however, to see that the attention of the Board of Trade has been given to this question of price and dividend, and that the adoption of the sliding scale of dividend inversely to the price of gas appears to the Board of Trade to be one necessary condition to the sanctioning of the amalgamation. And, indeed, after the letter addressed by the Board of Trade to the chairman of the select committee of the House of Commons on the gas bills, on the 31st of May last, in which the operation of the machinery of revising commissioners was so distinctly condemned, after the decision of the select committee in the same direction, and the subsequent legislation with respect to the Commercial Gas Company, it would be difficult to imagine the possibility of the Board of Trade sanctioning an amalgamation which would have the effect of bringing the consumers of another district, who are now well supplied and content with their position, under the operation of a system which has worked so injuriously for gas consumers.

Upon the question of the initial price of gas, that is to say, the figure from which any rise or fall in price is to start, the Board of Trade does not speak with so much decision. But it is to be observed that the initial price proposed in the bill of last year, 3s. 9d. per 1000 feet, received the sanction of the select committee of the House of Commons, after thorough inquiry, equally with the principle that the dividend should vary inversely with the price, and the Board has already resolved that it will agree to no increase of that initial price. Circumstances which have occurred since the last session of Parliament prove incontestably that that price is a liberal one. For instance, the Phœnix Gas Company, which is by no means the least heavily weighted with capital in proportion to its extent of business, and whose chairman gave evidence against the bill last sessions, has recently announced that after the present month its price per 1000 feet will be reduced from 3s. 9d. to 3s. 6d. The directors of The Gaslight and Coke Company themselves, also, in a letter addressed by their Secretary to the Board of Trade on the 30th of November last, "intimate that, under the existing state of the markets for the purchase of their raw materials and for the sale of their residual products, the period for a reduction of their price of gas below the price of 3s. 9d. now charged is fast approaching." It should therefore be distinctly understood that the price named in the bill of last session is the highest initial price the Board could consent to, and that, if that price be altered in any way, it must be by reduction.

Another point for consideration is the reserve-fund. The Gaslight and Coke Company has now no power to form a reserve-fund, whereby to make up the deficient profits of any year out of the surplus profits of a previous year. The Imperial and Independent Companies have reserve-funds, and, if the amalgamation should be effected under the power now possessed by The Gaslight and Coke Company, the reserve-funds must disappear, and not be again formed. In the Metropolis Gas Bill of last session, it was proposed that the companies should have power to form a reserve-fund in this way—that in any year in which, under the operation of the sliding scale, they should charge less than the standard price, and consequently be entitled to proportionately larger profits, they might, if they chose, add all or part of such increased profits to the reserve-fund, instead of increasing the shareholders dividends. This was the proposal in the bill of last session, which was approved by the House of Commons committee, was incorporated in the Commercial Gas Company's Act, and will be in the bill of the Board and the Corporation to be introduced next year. The application to the companies, now seeking to amalgamate, of the provisions of the bill of last session would, therefore, in this respect, be manifestly advantageous to them. It should distinctly be noted, however, that the clause authorizing the creation of a reserve-fund would only be operative when, owing to a reduction of the standard price, a company should find itself in the position of being able to divide among its shareholders profits above what has hitherto been recognized as the maximum rate. Nothing could be carried to the reserve-fund in any year in which the price was not below 3s. 9d. per 1000 feet.

In the scheme it is proposed to apply the existing reserve-funds of the Imperial and Independent Companies, which would become the property of the united company, to the payment of pensions, if authority be not given to create a new reserve-fund; but this would be improper. Pensions are in all other cases a charge upon revenue, and a different practice in the present instance would prevent a correct comparison being made with other companies. The need, however, of any such application of the fund would be obviated if the provisions of the bill of last session were adopted.

Upon the question of pensions, your committee would remark that no information is given in the scheme about the amounts of the pensions to be given to the officers of the extinguished companies. A liberal scale of compensation is provided for the retiring directors, but as to the officers pensions there is no information. It would be well to ascertain whether any agreements or understandings have been come to with any of the officers as to their retirement, and whether salaries have been recently increased with a view to swell the retiring pensions. Have the directors arranged to deal with the retiring secretaries after the manner of the Equitable Company? at the last meeting of whose shareholders, just two months before the amalgamation of the undertaking with that of The Gaslight and Coke Company was accomplished, and whilst the bill to authorize it was before Parliament, a resolution was passed increasing the secretary's salary to £1200 a year, for the reason stated by the mover in the following words, as reported in the JOURNAL OF GAS LIGHTING of the 9th of May, 1871:—"Mr. Andrews, the secretary of this company, had been in their service more than twenty years, and had most successfully negotiated the terms of the amalgamation with the Chartered Company, by which the permanent interest of the shareholders was secured. He thought it would not be necessary to say anything further in submitting the motion he was about to make. One of the terms of the agreement entered into with the Chartered Company was that Mr. Andrews should have a retiring allowance of £800 per annum, and he was sure the directors of both companies desired honourably to carry out that arrangement. Under the provisions of the bill before Parliament, he would only receive two-thirds of his salary, and the only way to secure the £800 a year was by passing such a resolution as the following:—'That in consideration of the long and able services rendered to the company by our secretary, Mr. Samuel Andrews, and with a view to facilitate the fulfilment of the agreement for amalgamation with The Gaslight and Coke Company so far as concerns him, his salary be and it is hereby raised as and from the 1st day of January, 1871, to £1200 per annum.'" It is to be feared that these amalgamations are promoted too often in the interests of directors and officers rather than to serve either consumers or shareholders. In other companies, within the last few years, great disasters have been seen to ensue from amalgamations promoted with such objects in view, and it is the duty of the public authorities concerned to see that no such vicious principles obtain here.

Another point which has occurred to your committee, in considering the preferential position to be assigned to the shareholders of the Independent Company, is, that any directors of this company who, after amalgamation, may become directors of The Gaslight and Coke Company, will, unless they purchase new stock, be holders of preference-stock, with a 10 per cent. dividend beyond the risk of diminution. This is a position calculated to lessen the incentive which it is desirable that directors especially should have for the exercise of prudence and economy in the management of gas undertakings—an incentive which it is the main object of the bill of this Board and the Corporation of London to provide. Your committee are, therefore, of opinion that the qualification of a director should be the holding of ordinary stock, the dividend on which would rise or fall, inversely with the price of gas, under the operation of the sliding scale.

There remains but one other point for your committee to refer to, but it is one of some importance. The conditions which the Board of Trade indicates as necessary to be accepted before any amalgamation scheme can be sanctioned, are conditions which the Board of Trade itself is unable to impose, which can, in fact, only be imposed by the authority of Parliament. And the object of the second letter of the Board of Trade your committee understand to be, that the conditions upon which the amalgamation should take place should be discussed by that department with this Board, the Corporation, and the companies, and that, in the event of the conditions being agreed upon, the amalgamation should be made the subject of a bill to be laid before Parliament. In that case, it appears to your committee that the Board, after expressing its views upon the question, should be free to consider the terms of any bill which may be introduced into Parliament.

In saying this, your committee desire to add that they are quite sure the Board will concur with the Board of Trade in the desirability of sparing the ratepayers the expense of a parliamentary contest, and any way of bringing about an arrangement satisfactory to the gas consumers, without incurring such expense, the Board would be very glad to adopt.

It is desirable that the views of the Board upon the proposed amalgamation should be communicated to the Board of Trade as early as possible, and, should the Board approve of the views expressed in this report, the most convenient course would probably be to send a copy of this report to the Board of Trade.

Mr. NEWTON: It is not necessary that I should take up much of the time of the Board in moving the adoption of the report, because a copy of that report has been sent to every member, and I have no doubt that it has been read by you all. But there are one or two things which it will be necessary to mention, because certain circumstances have arisen since this report was decided upon. In the first place, a communication has been made to the Board of Trade by the Chartered Gas Company, accompanied by a copy of the bill which they propose to submit to Parliament next session. That letter, which you may have seen in the public prints, intimates that the company are prepared to adopt the sliding scale as approved by the select committee of the House of Commons last session, with certain alterations, and I wish, as emphatically as I can to say at once, on behalf of this Board, that which I hope the Board will endorse, that we can under no circumstances consent to the alterations the company propose. They express their willingness to adopt the sliding scale, but they proceed to say in their bill that the initial price of gas should be 4s. Then they go on to say that they are willing that no increase of dividend shall take place until the price is reduced below 3s. 6d. Now, I think, we should have no objection to the latter proposal if 3s. 9d. were substituted for 4s. as the initial price. That would suit us very well, but I can only say that our bill will be introduced into Parliament in the exact terms in which it left the committee last session. We cannot, therefore, be charged with inconsistency or unfairness in what we propose. If the gas company wish for any alteration in that bill it must be certainly an alteration in the direction of a lower standard price. There cannot be any question of the fact—and everything that has occurred since the bill was introduced shows—that the proposal of the Board was a most liberal one. Indeed, I question very much whether the companies themselves do not now see that they were very much in fault, and that they neglected their own interests by not accepting the provisions of our bill at the time, for the chances are that they will not again get terms quite so favourable as those presented to them on that occasion. You have seen, I have no doubt, in the public papers, reports of the meetings recently held to promote the amalgamation of the Imperial and Independent with the Chartered Gas Company. If you have done so, you will have noticed that Mr. Beck, the governor of the

latter, stated that his company would derive many advantages from the proposed amalgamation. Then he said that the consumers also would receive advantages in the increased illuminating power of the gas afterwards supplied to them under the Chartered Gas Company's Act, which prescribes a standard of 16 candles, whereas the Imperial Company are now only bound to supply 14-candle gas, and the Independent, who are still under the Metropolis Gas Act, 1860, supply 12-candle gas only. Now it is a strange circumstance that almost at the very moment, certainly on the very day, when Mr. Beck was making that statement, Mr. Richards, the governor of the Imperial Company, was also making a statement in favour of the amalgamation to his shareholders. Referring to the same facts, he stated that, being allied with a very large company like the Chartered, it would give them great power, but, he said, "We must remember that we shall come under an Act of Parliament which prescribes 16 instead of 14 candle gas. That, however, cannot make much difference to us, because, at the present time, we are actually supplying gas of that quality." Then, again, I find the chairman of the Phœnix Company, only a few days ago, when making the announcement to their shareholders of a reduction in the price of gas, after the 31st of this month, to 3s. 6d., speaking in respect of the illuminating power (they being under the same Act as the Independent, which prescribes a standard of 12 candles only, which by the way is equal to 14 candles, as tested by the present burner), said, "We are supplying gas of almost as great an illuminating power as any other company," and he described their gas as being 15$\frac{4}{10}$ candles illuminating power at the present time. So that what was said by Mr. Beck cannot have such a very great effect, because, though Acts of Parliament may prescribe certain rates of power, if the companies themselves are to be believed, they are supplying to the public gas of a very much higher quality throughout the metropolis. I think, therefore, seeing that the Independent Company are now only charging 3s. 6d., and the South Metropolitan 3s., it is out of all consideration that there can be the slightest hope that the Board of Trade will sanction any increase in the initial price in the case of the Chartered Company beyond 3s 9d., and it may be that when Parliament come to consider the question of the Regulations Bill of this Board, or even the private bill of the company, they will arrive at the conclusion that 3s. 6d. will be a more equitable price than 3s. 9d. Then again, in the bill proposed by the Chartered Company, there is a section that relates to their borrowing powers, and which provides that the company are to exercise borrowing powers in the future, instead of raising large amounts of capital by issuing new shares. That section is framed in accordance with a suggestion contained in the Board of Trade letter last May, addressed to the charman of the committee of the House of Commons, to the effect that all future capital ought to be raised at the lowest possible rates of interest. Well, in so far it is good that they have made this proposition, but their bill provides that they shall be entitled to raise these loans at 6 per cent. interest. I need not say that that proposition would have received the most strenuous opposition of the Metropolitan Board during the last session of Parliament, and there is no doubt it will in the next. The Commercial Company, to whose bill the Board were not averse, agreed to raise their loan capital at 5 per cent., and, considering that the united companies will possess a total capital of between £7,000,000 and £8,000,000, and that of that amount only about one-sixth is loan capital at the present moment, and that there is really a share capital of at least £6,000,000, before which the loans would take precedence, there could be no difficulty, with such a security behind it, in raising money at the rate of 5 per cent., or even less. It is, therefore, out of the question again, for this Board at all to think of agreeing to a section which would entitle the promoters of the bill to raise money at 6 per cent., their debenture bonds for which would, so soon as issued, be immediately of the value of £120. I think, therefore, that we should clearly intimate to the company that the proposal in their bill to raise loan capital at the rate of 6 per cent. would be opposed by us. Another clause which the bill contains, and which is inconsistent with existing legislation, is that they should be allowed to raise a fund equal to one-twentieth of their whole share capital—which, in the case of the united companies, would amount to something over £300,000—and that they should raise it not out of the maximum dividend to which they would be entitled—*i.e.*, 10 per cent. so long as they are charging 3s. 9d., or a larger rate so long as they charge less than 3s. 9d.—but out of the profits they might realize beyond 10 per cent. at the price of 3s. 9d. And this fund of one-twentieth of the share capital is in the first instance to be applied to the purpose of meeting any accident, or such extraordinary occurrence as human forethought cannot provide against, and after that it is to go to make up any deficiency of dividend which may have accrued in previous years, or in the present year. Now, this is a wholly inconsistent provision with recent gas legislation, and with the terms upon which the Board have settled their Regulations Bill. First, you see they propose to pay themselves the full dividend to which they are entitled by law, and after that they propose to create a reserve-fund, which is to be held for the purpose of providing against future contingencies which may reduce that dividend. There is no company that I know of but what provide their reserve-fund out of the profits which would otherwise be divisible amongst their shareholders. If a gas company make 6 per cent., and are content to divide five amongst their shareholders, and to appropriate 1 per cent. as a reserve, to accumulate with interest from time to time, as a guarantee for future dividends, I can understand that; but there is no principle which has been more clearly laid down than this, that all the profits which accrue beyond those necessary for the payment of 10 per cent. to the shareholders belong to the consumers. It has been over and over again declared in various Acts of Parliament that whatever sums accumulate beyond the payment of maximum dividends of 10 per cent. must go in the reduction of the price of gas. Yet we find now, in clear violation of that principle, it is proposed by this company that when they arrive at the payment of these maximum dividends, and have something to spare, instead of reducing the price of gas to the consumers, they shall be allowed to put that surplus aside, to the extent of £300,000, in order to secure that in the future, whatever their management may be, they may never receive less than their 10 per cent. I feel sure that this Board will, in the future, as they have done in the past, refuse to sanction a reserve-fund created in such a way, and established for such a purpose. We did not at all object that the Commercial Company should do what they proposed, and we should not object to this company doing the same—viz, if they are entitled to more than 10 per cent. by reason of their having reduced the price of gas to 3s. 6d, that instead of dividing the whole of the dividend to which they are entitled, they should, if they choose, place the surplus beyond 10 per cent. to a reserve-fund. The money is theirs, and whether they divide the whole of it at once, or reserve part for future contingencies another year, it will be no business of ours, except that we shall be pleased to recognize in the fact, that the company are exercising that prudence in the management of their affairs which we desire to promote. But we shall certainly object to the proposal to create this reserve-fund out of the price paid by the consumers—out of the moneys properly belonging to them—seeing that there ought to be a reduction in the price of gas if the profits of the company are more than sufficient to pay their dividend. I think these are almost the only points that I have to advert to, in addition to those stated in this lengthy report. You will not require, nor would it be fair, that I should tax your patience by reading the various statements made in the report. It has been carefully drawn up; the facts are perfectly accurate, and it is to my mind a terrible indictment against the amalgamations which have taken place. I believe I am justified in saying that even the Board of Trade, who, with ourselves, some years ago, thought much good would result from amalgamation, have come to the conclusion, after the experience of the amalgamations which have taken place, that there is not much benefit to be derived from them, and that there is often greater benefit from keeping competing companies in existence, so that we may draw comparisons between the excellent management of one and the bad management of another. I think also, I may say in conclusion, that we ought to congratulate ourselves upon the progress of those principles adopted by the Board more than twelve months ago. The present proceedings show that our proceedings then were based on justice. I know that they were carefully considered before the Board did adopt them, and I believe we are right in maintaining them. At the same time it is our duty to take advantage of any new circumstances which arise, and it will be the fault of those companies who scornfully refused to adopt the propositions of the Board last session, if they find they are not quite able to obtain terms quite so good now as they would have had at the time our bill was before Parliament. I move the adoption of the report of the committee.

Mr. Elt seconded the motion.

Mr. Leslie said he should not go into the merits of the case, but he might be allowed to say that there was some vagueness in one or two places in the report where reference was made to the amalgamations which had taken place "under the provisions of the Act of 1868." Now, there were two Acts passed in that year, and the one referred to in the report was evidently the "City of London Gas Act, 1868." As the Parliamentary Committee intended their report as a kind of manifesto, and were sending it to the Government as a sort of historical document, it would be well to be as precise as possible in the language employed.

Mr. Newton said he did not see the necessity for the alteration, but if the honourable member thought it would make the statements more explicit, he should offer no objection to it.

Mr. Freeman said it became more apparent every year, that whatever shape the gas question took, and whether the supply was in the hands of a dozen companies or only one, the directors and proprietors were working only for themselves, and were looking more after their own interests than the interests of the public. It was clear also to his mind that there was little or no hope of the supply of gas being managed for the real good of the community until the undertaking was handed over to the management of the public authorities. What was the great fact pointed out by the report just presented? Why, that the companies were not content with their 10 per cent. dividends, but were seeking to obtain 11, 12, 13, or even 14 per cent.—10 per cent. to be paid immediately, and the remainder to be carried forward to a sinking-fund for their own benefit hereafter. Instead of being satisfied with 10 per cent., they were grasping at something beyond, that they might create a reserve for their future advantage. This was the great thing against which the Board ought to fight most strenuously. There were other matters of some importance, but, in comparison with this, they were of minor consideration. The report clearly showed that the companies were not willing to keep to the contract which their Acts of Parliament made with them. They talked about attempted robbery by this Board, and confiscation by the Legislature, whereas the bill contained a direct attempt to rob the consumers, by taking from them more than the 10 per cent. to which they were entitled.

Mr. Edwards thought the companies were being very tenderly treated by the Board, who fixed the initial price at 3s. 9d. In his opinion, it ought to be 3s. 6d. The gas companies had never kept faith with the public. Instead of raising additional capital at 5 per cent. on debenture stock they created shares, which were entitled to 10 per cent. As the companies would not keep faith with the public, he thought the public should not keep faith with them. He had no doubt, however, that the companies would be very glad in the end to accept the terms the Board offered them.

Mr. Richardson said there were two important matters not referred to by Mr. Newton. The first was that in the proposed amalgamation the Imperial and Independent Companies were to be guaranteed 10 per cent.

Mr. Newton said the guarantee only extended to the capital of the Independent Company.

Mr. Richardson thought the principle of any guarantee at all was most objectionable. Assuming hereafter that this Board, or some other board of government for the metropolis, should purchase the undertakings of the companies, which he took to be almost a certainty in the future, this proposed guarantee of 10 per cent. would be a serious matter, because the persons to whom it was given would require a much larger sum for their interests than the ordinary shareholders. Another thing that occurred to him was that, if the companies were required to borrow all the further capital they might require, there seemed no reason why they should not be compelled to borrow at less than 5 per cent. He suggested that a power might be inserted in their Act to borrow the money from this Board, who could raise it at a cheaper rate on metropolitan stock. It was, in fact, only reasonable that, as the companies themselves would get no profit out of any new capital raised in this way, they should raise it at the cheapest possible rate. If they borrowed from the Board, in the course of time the Board would become so largely connected with the companies that it would much facilitate their being handed over eventually to the local authority, whatever it might be. He did not see why, in making future parliamentary arrangements, this question should not be fully considered by the committee.

Mr. Dresser Rogers thought the principal reason why the Board should pass the report, and oppose amalgamation, was to be found in a consideration for the interests of the consumers. In the Independent Company's district consumers were now paying 3s. 6d. per 1000 for gas, but the moment the amalgamation took effect they would be raised to 3s. 9d., and if the revision clauses of the Chartered Company's Act were not repealed, they might be still further increased to 5s. The Great Central Company, if they had not been amalgamated, would at the present time be supplying gas at 2s. 6d. For years before that amalgamation they were making a profit of 13 or 14 per cent. It was true the shareholders did not get the whole of it, but beyond what they received, Mr. Higgs did; and if it had not been for his defalcations, the company could then have reduced the price of gas. Were not the public justified in saying that the reason why the amalgamations were sought by the great companies was, that they discovered that, with their large expenses, they could not supply gas so cheaply as the small companies, and that, so long as those small companies remained in existence, and were able to make gas at 25 per cent. less than they could, that it was their interest to annihilate those small companies, and so destroy the evidence that they themselves were not working economically. He regretted to find that the consumers in the Independent Company's district were so apathetic about the amalgamation now proposed. They ought to be moving in the matter, and he had expected to find them coming up to the Board, asking them to go to Parliament and prevent such a step being taken. But he had now given up all hope of the House of Commons doing anything for the public in this question. The only effectual remedy was for the local authorities to acquire both the gas and water works of the metropolis. In no other way could justice be done to the consumer.

Mr. Fell said the Independent Company supplied the whole of Shoreditch, and therefore the proposed amalgamation affected that parish considerably. The vestry had addressed a communication to the Board on the subject, and a public meeting would shortly be held to protest against the arrangement.

Mr. Newton, in reply, said he quite agreed with Mr. Richardson, that whatever was done should be done so that in the event of purchase hereafter, the price of shares should not be improperly enhanced in value, thus obliging the body purchasing to pay a higher sum than was right under the circumstances. But he could not see his way clearly to adopt the suggestion that the Board should raise money from the public at the rate at which they could raise it, and lend it to the gas companies. He was afraid very much that Parliament would

never sanction such a proposal, and he doubted much whether the public would like that the rating power of the Board should be pledged and mortgaged for the benefit of the companies, although, in view of a future purchase, an increase in their capital, raised at 3½ per cent. instead of 5, would lessen very much the cost at which the works could be acquired. He felt, too, that the principle was so fraught with danger, and would give rise to so much discontent, that he despaired of seeing such a proposal adopted, nor could he make up his mind that it would be the proper thing to do. Gas companies had a very good security to offer for borrowed money. After the amalgamation, there would be about six millions of share capital at the back of any loan they might offer to the public, and it would not be right for the Board to add to that security the whole rateable property of the metropolis. That being so, he did not see how the Board could at all enter upon the question at the present time. All they could do was to watch carefully to see that money raised by the companies in future was raised upon such terms as not to enhance the purchase value of the undertaking. He quite sympathized with Mr. Rogers who lived in a district supplied with gas at 3s., and with Mr. Fell, whose district was supplied at 3s. 6d., should the proposed amalgamation proceed without consideration for their interests by the authorities, and simply under arrangements between the officers of the companies. He very much feared that this was what had taken place before, and he thought there was great danger in these amalgamations. At the recent meeting of the Independent Company, to consider the question, a strong feeling was expressed by the shareholders present in opposition to the scheme, but the directors carried its adoption by the help of proxies. This use of proxies on such occasions was one which would have to be decided. The secretary of a gas company, as representing the directors, could be in communication with the whole of the shareholders, and readily obtain proxies. Shareholders of gas companies were very many of them trustees, and widows, and others of a class which was not continually changing investments, and they were very well satisfied with not attending the meetings of the companies, so long as they received their dividends regularly. Not knowing, therefore, anything of the policy of matters about to be discussed, they usually agreed very readily in what was told them at the office, and the directors found it very easy to get proxies. And how were the secretaries themselves interested in amalgamations? Why, when these events took place they received certain pensions, which in some cases amounted to two-thirds of their salaries. In the case of the Equitable, even that was not considered ample enough for the gentleman, who had exercised great activity in promoting the amalgamation. How did they evade the Act?—for that is what it amounted to. Why, just two months before the amalgamation was effected, his salary was raised from £800 to £1200, in order that when superannuated his retiring allowance might be equal to his full salary. Can we, therefore, wonder at the secretaries being active in getting proxies, and that the views of persons present at the meetings, and who are prepared to ask questions should be overruled. The directors themselves, also, on the occasions of these amalgamations, are also very largely pensioned. I believe the directors of the Equitable, if they retired, were each to have £2000, or a little more. Can we wonder, then, that proxies are sought for, and that the views of thinking and independent shareholders are overpowered. In all these arrangements the consumers are sacrificed altogether. In the Independent district, the moment the amalgamation takes place, the price will be raised from 3s. 6d. to 3s. 9d., and this advance, in the case of the public lamps, will make a difference of from £700 to £1000 a year. It is the duty, therefore, of this Board, as representing the ratepayers, to take steps to put a stop to it.

The motion was put and carried.

METROPOLIS WATER SUPPLY.

SOUTHWARK AND VAUXHALL WATER COMPANY.—The Half-yearly Meeting of this Company was held at the Office, Sumner Street, Southwark, on Thursday, the 9th inst., when the following report of the directors, was presented:—

"The directors beg herewith to submit to the proprietors the half-yearly accounts of the company to Sept. 30, 1875, which have been duly certified by the public auditor appointed by the Local Government Board, and by the auditors of the company.

"The state and condition of the company's works continue to be satisfactory. The additional works at Hampton are now in operation, and those at Peckham are completed, and the trunk mains to connect them with the company's works at Hampton and Battersea are being laid.

"The Local Government Board, on the report of their inspector, have seen fit to give their sanction to the proposal of the vestry of Richmond to borrow money for constructing an artesian well and other works for supplying Richmond with water; and it is understood that the vestry propose at once to raise the necessary funds to carry out these works. Having regard to the expenditure incurred by this company with reference to the supply of Richmond, and to other attendant circumstances, the directors have, in this position of affairs, deemed it their duty to take active measures in protection of the company's interests. They have accordingly ordered all the needful preliminary notices and other steps for enabling the company to apply to Parliament in the next session for power to continue and improve the company's supply in the Richmond district, and to make all proper arrangements with the vestry of Richmond and other local authorities respecting it. The directors have also deemed other measures necessary, and have directed them to be taken. It would be inconvenient to enter more fully into these matters on the present occasion; the proprietors may, however, rely that, in the hands of the directors, they will be watched and followed up with vigour and also with discretion.

"The increase of the company's water-rental for the half year to Sept. 30, 1875, is satisfactory.

"The directors recommend that a half year's dividend at the rate of £5 5s. per cent. per annum on the ordinary stock and class D shares, £5 per cent. per annum on the preference stock and on the amount paid on the preference shares, and £4 10s. per cent per annum on the ordinary shares and on the instalments paid on the new ordinary No. 1 shares, be declared payable on Jan. 15, 1876."

SOUTH METROPOLITAN GASLIGHT AND COKE COMPANY.

An Extraordinary General Meeting of the Proprietors of this Company was held at the London Tavern, Bishopsgate Street, on Monday, Dec. 6—THOMAS BRIDGE SIMPSON, Esq., in the chair—to elect a director in the place of William Baker, Esq., who had resigned.

The SECRETARY (Mr. Livesey) read the notice convening the meeting, also a letter from Mr. Baker, announcing the resignation of his seat.

The CHAIRMAN said the business of the meeting was a very simple one, and would occupy but little time. The only proprietor who had announced his intention to become a candidate for the vacancy at the board was Hilton Jenkins, Esq.

The SECRETARY read a letter from Mr. Jenkins, intimating his intention to offer himself as a director.

Colonel EWART: I beg leave to propose the election of Mr. Jenkins as a director of the company.

Mr. B. L. SMITH: I have great pleasure in seconding the motion. I have known Mr. Jenkins for several years, and I have no doubt that his great legal knowledge will prove very valuable to the company. I believe him to be in every respect a thoroughly good man, and well qualified for the important duties devolving upon a director of this company.

The motion was put and carried unanimously.

Mr. JENKINS, on taking his seat among the directors, said: Gentlemen, on coming to this side of the table, the first duty I have to perform is a natural and very grateful one; it is to thank you for having placed me in the honourable position of a director of this company, under circumstances which, I think I may say, are very gratifying in themselves. Mr. Baker, the retiring director, immediately after the last meeting, and before leaving this house, came to me and said it was his intention to resign his office, and he wished it to be clearly understood that his desire to do so arose from no feeling of disrespect to the shareholders in consequence of the proceedings of that day. He told me that he had been connected with the company for many years, and that he had experienced much kindness from the shareholders; but, he said, the fact was that the state of his health required that he should take some rest and recreation, and the opportunity of being more in the country. I sincerely trust that that rest and recreation will be obtained by him so as to restore him again to his accustomed health. Another circumstance, which is gratifying, is this, that upon Mr. Baker having notified his intended retirement, Mr. Paull, one of the auditors, and a candidate for a seat at the board on a former occasion, contemplated standing for this vacancy. But he took the precaution to make some inquiries, and he found that the inquiries he did make resulted in showing him that the probabilities of his success were not quite what he expected. He, therefore, in the handsomest manner, determined to give no unnecessary trouble, and at once intimated his intention not to enter upon a contest. Practically, therefore, this is an uncontested election, and there is no sense of disappointment attached to it from the circumstances of defeat to any one. I am quite aware that the result is mainly to be attributed to the fact that I became a candidate under the auspices of the gentlemen whose names I was permitted to mention in the circular announcing my candidature. All these gentlemen have been long connected with the company, and, possessing great influence, would necessarily determine the result in any election. I should say, in justice to myself, that these gentlemen invited me to come forward on grounds perfectly intelligible—viz., that I had formed views of my own, quite independent of them, as to the policy this company should pursue. I expressed those views, and they happened to coincide with the views of these gentlemen, and they accordingly wished me to represent them at the board. It is my intention to do so; and that there may be no mistake about those views, I may state that I have always thought that this company is so sound and good a concern that we ought, by all means in our power, to preserve its integrity so long as we prudently can. But, in saying that, I cannot shut my eyes to the fact that, as amalgamation or purchase, or something of the kind, has hung over our heads in the past, so it will hang over our heads in the future. I think it is looming, not in the distance, but is very closely before us; and when we are in a position to have an offer from any other company, it will be the duty of the directors to take care that the terms of amalgamation shall fully represent the intrinsic value of the property of this company. That is the first business. We shall then have nothing to do with the consumers. At present we can consider the consumers, and I believe the independent position of this company will operate best for their interests. Gentlemen, I do not know that I can venture to occupy your time further to-day on a matter which has so much in it of a personal character, and I will therefore only add that I thank you and the gentlemen who allowed me to use their names; and I will ask you to join me in a vote of thanks to the chairman and the other directors of the company.

Mr. PAULL seconded the motion, which was put, and carried unanimously.

The CHAIRMAN: Gentlemen, I have to thank you very much for the compliment which, on the motion of my friend, Mr. Jenkins, you have paid to us. I can assure you that I believe the directors, one and all, are determined to support the interests of the company to the best of our abilities, as we have hitherto done for many many years. And I may add this further assurance, that in what has previously taken place we believed we were thus acting. In my judgment, 10 per cent. is not in any respect a larger return than we ought to receive, looking at the various contingencies to which we are liable. Whatever else may take place therefore, we must maintain our right to this. Gentlemen, I thank you for the compliment paid to me and to my brother directors, and again assure you we shall not be unmindful of our duty to the general body of shareholders in the company.

The proceedings then terminated.

A SOLID GAS-FLAME.

It is generally believed, that in the flame of the Bunsen burner, and other round flames, a hollow space, forming a core in the base of the flame, is an essential part of its structure.

Mr. John Wallace, of 3, St. Nicholas Buildings, Newcastle-on-Tyne, has patented a form of burner which involves a new theory on the structure of flames. During a series of experiments made to determine the amount of air which could be mixed with coal gas previous to combustion, he observed that as the proportion of air increased, the hollow space became smaller, until it disappeared; and it became evident that some important modification was necessary in the design of the burner, in order to burn such inflammable mixtures, without allowing them to strike back or light within.

A cylindrical cap of finely perforated metallic plate, fitting over the top of the burner tube, solved the difficulty, and the result was a perfectly solid flame of great vigour and intensity, burning above a tube 2 inches in diameter.

A piece of platina wire, stretched through the flame ¼ of an inch above the cap, became immediately white hot throughout the entire length enveloped in the flame, and no difference was observable in the heat of any part immersed.

The rate of combustion was 40 feet per hour, and the proportion of air mixed, previous to combustion, 4·6 volumes.

The cap is equally applicable to any size of tube from ¾ of an inch to 2 inches in diameter, and, being adjustable to varying heights, it regulates by back pressure the amount of air drawn in at the holes near the gas-jet. Combustion may thus be made to commence at a short distance from the cap, in order to avoid oxidation.

This burner will burn coal gas of any quality without the risk of striking down when lighted or turned low.

The under surface of the flame where combustion commences is indicated by an intensely brilliant green undulating film, which, when examined by the spectroscope, gives the spectrum of carbonic oxide.

This flame deposits no solid carbon, and gives off neither carbonic oxide nor acetylene in quantity appreciable to the sense of smell.

A burner consisting of twelve 1-inch tubes, and capable of burning 240 feet per hour of gas, has raised steam for the past nine months in a printing office in Manchester, driving three printing machines, at the cost of 75 cubic feet per hour.

DRAWING AND CHARGING GAS-RETORTS.

At a Meeting of the Society of Engineers, held on Monday, the 6th inst.—J. H. Adams, Esq., the President, in the chair—

Mr. F. W. Hartley read a paper on "An Improved Method of Charging and Drawing Gas-Retorts."

The writer commenced by stating that it was not his intention to enter upon a lengthy recital of historical facts, or to give an elaborate description of the many mechanical contrivances which had been invented for facilitating the production of gas from coal. It was, however, impossible to avoid altogether a reference to the past, because the conditions under which coal gas was now manufactured were based, to a very important extent, upon the experience and recorded enunciations of engineers and chemists, who, for the greater part, had gone to

> That undiscovered country, from whose bourn
> No traveller returns.

After the discovery that illuminating gas could be produced by the distillation of coals in closed vessels, and when it became a question of turning that discovery to profitable account, the first problem which had to be solved involved the determination of the form and dimensions of the distilling vessels or retorts, the manner in which they should be set in the ovens so as to be effectually heated, how they were to be charged with coal and the resulting coke be removed with facility, as well as the manner in which the gas and vapours should be conveyed away as fast as they were generated. Retorts of a variety of shapes were tried, but were soon given up in favour of the tubular form, round, oval, or D-shaped in cross section, and these were set vertically, diagonally, and horizontally, the last arrangement being finally decided upon as the best in every respect, and prevailing at the present day.

It had been said that the present system of coal gas making was more crude and unphilosophical than, perhaps, any other commercial manufacturing process in which the principles of chemistry were concerned, and at first sight there appeared to be a good deal of truth in the allegation, for principles and practice alike taught that if coal were distilled in thin layers, the yield of gas per ton would be greatly larger than when it was presented for distillation in a thick mass. Further, that the prolonged distillation of thick masses of coal at high temperatures led to the production of a greater per centage of those sulphur compounds which were so objectionable, and so difficult to remove, to any great extent, by purification. Dr. Odling had expressed an opinion that the chief proportion of sulphide of carbon found in coal gas was produced in the later stages of distillation—that was, when the retort, and those portions of its contents which were in contact with the retort, had become intensely hot, and the centre of the mass was being really carbonized. In the third edition of Clegg, it was said that in all cases with the same degree of heat, the thinner the layer of coal, the better the gas; and further, that it was well known to every one connected with the manufacture of coal gas, that a thin stratum was desirable. Chemistry, it was added, "points out the various causes and effects. The quantity of tar and ammoniacal liquor is much increased when the coal is acted upon slowly, as the centre portion must be when decomposed in mass."

The usual system of coal gas making involved a complete disregard of the foregoing facts. Some 2 to 2¾ cwt. of coals were thrust at one time into a retort 9 or 10 feet in length, and were presented in an irregular mass of uneven thickness to the action of the heat. To compensate as far as possible for the defective manner in which they were so presented, and to obtain volume of gas, the temperature of the retorts was raised to the highest practicable degree. By this means an approximation to the volume obtainable by distillation in thin layers was secured; but only at a sacrifice of some portion of those richer hydrocarbon gases upon which the luminiferous value so much depended. Hence, when gas was produced at very high temperature from ordinary Newcastle coals, and must be of, at least, 15 or 16 candles illuminating power, it became necessary to enrich it by a considerable admixture of that from cannel coal. Again, the opening of the retorts at regular intervals of a few hours was objectionable, on the ground of economy, inasmuch as this practice caused the retorts to be cooled by the direct influence of the atmosphere, to an extent dependent on the time occupied in drawing and charging, leading to waste of gas and fuel, and a heavy expenditure in labour for charging, drawing, wheeling, and water-quenching of hot coke.

Yet, in spite of the objections and disadvantages enumerated, gas makers universally continued the use of horizontal retorts, charged intermittently with heavy and irregular masses of coal; and so strong apparently was the conviction that the horizontal setting and the intermittent charging were the most advantageous arrangements which could be adopted, that every really important invention for facilitating the removal of coke from, and delivering coal into the retorts, consisted of machines or appliances for perpetuating the established system. Descriptions and illustrations of the inventions which had attracted the most attention would be found in the interesting paper of Mr. John Somerville "On Charging and Drawing Retorts by Machinery," published in the proceedings of the society for the year 1873. Several machines had, however, since been patented; most of these, however, were but variations of a type. Possibly the most original was that invented by Mr. Foulis, of Glasgow, which was actuated by hydraulic instead of by steam power. It was said to do its work well, but the author had not seen it in action, and could express no opinion on its merits.

There must, then, be some very strong reason for the continuance of horizontal retorts and intermittent charging and drawing, for it was not to be supposed for a moment that gas makers were ignorant of the disadvantages attending the present system, or were indisposed to conduct their operations in accordance with the teachings of science and of experience. What, then, justified the present practice? The answer was embodied in the fact that the gas maker was also an extensive manufacturer of coke, which he must dispose of to the extent of about two-thirds of the bulk produced. To be saleable, coke must possess certain qualities, such as a moderate degree of hardness and cohesion, and it must be well suited for the generation of heat. Coke of such character was not to be obtained from coals distilled under conditions most favourable for the production of gas in the largest volume and of the highest illuminating power. On the contrary, coke obtained from coals distilled under such conditions was light and cindery, tending to break to powder when but little pressure was applied to it, and was next to worthless as a fuel. If such coke were made it would be a drug on the hands of the gas maker, unless indeed it were almost or quite given away.

The writer next referred to the horizontal setting of retorts and intermittent charging in large masses, in lieu of continuous charging in comparatively small quantities. Dealing with the last idea first, he observed that the minds of many clever men had been engaged upon the subject, but there were certain obstacles to its being carried out practically, which appeared to him insurmountable. One of these objections was, that for every increment of coal thrust into the retort, an equal mass of coke must be ejected, and this must be accomplished without loss, or with a very trifling loss, of gas. Brunton's method was the father of nearly all succeeding methods, and, like most of the rest, necessitated the projection of the coke into water and tarry matter, thereby seriously deteriorating its value. There were these further disadvantages attending any such arrangements—viz, that the coke was also very much broken up, with the production of an undue proportion of small or "breeze," and that with every discharge of coke into water, a volume of steam rushed up into the retort, thereby producing a seriously prejudicial cooling effect, while the attachment of pipes and chambers at the end of the retort through which the discharge and in which to cool the coke without the aid of water, the author's experience convinced him, must render the maintaining of the proper heat for distillation almost impossible, and certainly very costly as regarded furnace fuel, besides being objectionable by reason of the danger of explosions and of the greater contamination of the gas with impurities. On the second point he remarked that retorts were set horizontally, because that arrangement permitted a greater number to be put into a given space, and to be heated with the least expenditure of fuel, while at the same time it rendered the charging and drawing easier, and therefore more expeditious than any other plan.

The author stated that he had thus far dealt with facts and reasonings, because he wished clearly to show:

1. That gas making involved a compromise with coke making.
2. That the present system of arranging retorts was probably the best which could be adopted.
3. That intermittent charging and drawing were best suited to fulfil the obligations accompanying gas production; and,
4. That there was a limit beyond which the gas maker must not pass in the production of volume at the sacrifice of quality in coke.

The present system of charging and drawing was undoubtedly open to modification and improvement—not, however, as the author thought, in the way of radical change, but in the direction which it was his purpose to indicate.

It was greatly to be desired that the labour of the retort-house should be rendered less trying for the stokers—that gas companies should be less dependent on trained and experienced stokers; that the cost of labour per ton ofc coals distilled should be reduced; and, lastly, that the maximum quantity of gas of the highest practicable illuminating power, containing the smallest possible quantity of sulphides of carbon, should be obtained, consistent with the production of a good coke.

In the construction of charging and drawing machines generally, no consideration appeared to have been given to the last condition; and in respect to manual labour it seemed to have been thought that the only possible way to relieve stokers from the tax on their physical powers, and the companies some cost, was to dispense with manual labour almost entirely, by substituting expensive and heavy machinery, only adapted to very large establishments.

In the year 1873, Mr. John West, of Maidstone, was induced to turn his attention to the subject, with a view to produce machinery which could be worked by manual power, and which would be alike applicable to large or to medium-sized works, if not to very small ones, and in so doing he not only sought to render the labour less irksome and less costly, but also to obtain better results in quality and quantity of gas.

In the ordinary or usual method of charging, a semicircular scoop of the same length as the retorts was employed, and this was filled with coal, when upon the floor, and was next lifted by three men, thrust into the retort, turned over and withdrawn empty—two scoopfuls of coal generally constituting the charge for each retort. For drawing, a long rod, having a bow handle at one end and a right-angle bend, flattened at its extremity to form a rake, at the other, was used. The rod was heavy, and the rake end was, with considerable effort, jerked into the retort mouthpiece. The stoker then commenced a struggle with the coke, and, after much exertion, succeeded in dragging it out, leaving, if he were careless, no inconsiderable quantity still undrawn. This was probably the most trying part of the work, as the stoker must approach very close to the retort to clear the coke from the back, and as, at first, he must draw some part of the front portion, he had, except in stage houses, to face and endure the heat both from the retort and from the hot coke drawn therefrom. Were it not for the profuse perspiration which this labour and the exposure to fire induced, such work could not be accomplished.

The first conception of originality on the part of Mr. West was in the charging machine, which consisted of a wrought-iron carriage running on wheels. The carriage was partly open at the top, and the bottom consisted of a plate divided into a number of ports of equal width. Beneath the bottom there was a second sliding plate, having ports of the same width as those in the bottom of the charger; so that, according to the position of the sliding plate, the ports might be opened or closed. Attached to the front of the charger there was a coupling arm, for the attachment of a long rod. This arm was free to revolve, and had affixed to it a bevel wheel gearing into a second bevel wheel, which was attached to a crank actuating the port slide. A half turn of the arm sufficed to move the slide to the needful extent to cover or to uncover the bottom ports of the charger. The wheels of the carriage were serrated to secure a slight vibration of the charger when running, and the certain delivery thereby of the contained coals.

The second novelty consisted of a trolly, formed of a framework of wrought iron, with runners to travel upon rails laid in front of the retort benches. This trolly carried a hopper and a sliding stage, attached or otherwise to each other, suspended by chains attached to a winding drum so as to be easily and expeditiously adjusted to suit retorts at different elevations. The bottom of the hopper terminated in a rectangular-shaped shoot of nearly the same length as the space at the top of the charger. This shoot was fitted with a four-bladed roller, the spindle of which projected through the end of the shoot, and was provided with a handle to revolve it. The trolly was moved along the rails by turning a propelling wheel rotating a pinion gearing into a spur-wheel affixed to the shaft of two of the runners. Attached to the back of the stage, a drawbridge spanned the space between the stage and the retort mouthpiece, and was lowered or raised by means of a rod.

The charger being placed upon the sliding stage, and the latter adjusted to suit the elevation of the retorts to be charged, the handle was turned a few times, and the coals falling from the hopper filled the charger, to which was previously attached a long rod with a cross handle. The bridge being lowered, the charger was driven by one man to the back of the retort, were a half turn was given to the handle, and the bottom ports were thus opened. The charger was then drawn forward, and by the time it reached the mouthpiece had deposited the coals which it originally contained in an even layer of about 3 inches in thickness upon the floor of the retort. When the charger reached the stage the bridge was raised, the trolly moved on to the next retort, and the operations repeated.

The hopper of the trolly was supplied with coals from a fixed hopper, placed at any convenient position in the retort-house over the line of rails in front of the benches. Coals were raised into the fixed hopper by means of a leather belt, carrying iron cups (commonly called a Jacob's ladder) from a pit below the floor level, which contained the coal-breaker; the latter consisting simply of thick saw-tooth rollers moving at unequal speeds. At Maidstone the coal-breaker and the hoist were driven by a band, actuated by the engines which work the exhausters and pumps of the works.

The third novelty consisted of a drawing apparatus. One of the difficulties to be overcome in mechanical drawing was the tendency which, from its length, the drawing-rod had to bend, striking the coke before it could reach the back of the retort, and thereby opposing great resistance, and this difficulty was increased under the common system of charging by the very irregular surface of the coke. Hence in all other drawing machines the drawing appliances were exceedingly heavy, in order that they might be as rigid as possible, with little tendency to bend or droop. To overcome any difficulty of this kind, Mr. West welded a curved arm, near to the end of the drawing-rod, and to this he attached a kind of slipper, so that when pushed into the retort the slipper took an easy bearing on the coke. The rake consisted of a semi-disc, of the width nearly of the retort, suspended freely upon the turned end of the rod, so that it always hung in the required position. When the rake was pushed forward the slipper was, of course, downwards, but on reaching the back end of the retort a half

turn of the rod threw the slipper upwards, and allowed the rake to fall into position for drawing, while any tendency on the part of the rake to rise and slip over the coke was checked by the immediate contact of the slipper with the roof the retort. The rake rested on sheaves attached to a light framework of iron, furnished with wheels, so as to run on the same rails as the trolly already mentioned. The sheaves were attached to slides which are suspended from a chain passing over the pulley to the drum attached to the front of the frame-work, and which was turned by a worm and wheel.

Before making any statements as to practical experiences with the machines just described, the writer thought it would be interesting to the members to receive an exposition of the system of working originally contemplated by Mr. West. The trolly and charger, although improved in certain particulars since, were in principle of construction the same as now used, except that the back end of the charger was furnished with a vertical sliding plate of iron, capable of being elevated and depressed within certain limits. This plate was attached by a cam arrangement to a rod forming a prolongation of the coupling arm, so that when the bottom ports of the charger were closed, the edge of the vertical plate nearly touched the floor of the retorts, but when the ports were opened the plate was raised about three inches clear of the retort floor. The back and front lids of the retorts having been removed, the charger filled with coals was pushed into the retort, driving out the coke before it. As far as the mere operations were concerned, the system was a perfect success. On the occasion of the author's first trials, during the five days working, with 1 cwt. charges and seven retorts, the yield of gas per ton was 12 per cent. greater than the yield obtained from the same coals on the ordinary system as practised at the Maidstone works; or in other words, the yield was increased from 9600 cubic feet per ton to over 10,700 cubic feet.

The question of the character of the coke, however, soon arose, and exception was taken to it as too light and friable and unfit for storing or much handling. To get over this difficulty, the charges were raised in weight to 1½ cwt., and at last to nearly 1¾ cwt. At this last-named weight a good and satisfactory coke was obtained, with an increased volume of 5 per cent. in gas. These last-mentioned trials extended over nearly a week, and were made with 14 retorts. During these trials the fuel account was very heavy, and the suspicion began to arise that this was due to the presence of two mouthpieces and the opening of the retorts at both ends. However, as Mr. West wished to submit the system to a crucial test, it was resolved to put up retorts enough, 56 in number, to meet the whole requirements of the town during the summer months. These were erected, but, in order that they might be used, if needful, as close-ended retorts by bricking up, the stand-pipes and also the furnaces were placed at the charging end. The author first operated with these on the old system, with the usual weights per charge, and then charged them by the aid of Mr. West's machine. The result was an increase in the volume of gas of nearly 5 per cent. from the evenly laid and lighter charges. This and other trials led the author to the conclusion that about 5 per cent. in the volume of gas was the maximum increase obtainable by any improved system of working, due regard being given to the quality of the coke as well as quality of gas. Coke good and fuel expenditure reasonable. The closing bricks were then removed from the back mouthpieces and the coke driven through, when the yield of gas began to diminish, and after a few charges had been worked off the retorts were so reduced in temperature as to be unfit for profitable gas making.

Here, then, was the solution of the high fuel accounts, and also a practical demonstration that the loss by convection and radiation from mouthpieces and iron connexions of any kind at the back of a single retort is so prejudicial as to justify the rejection of almost any system of working which demands such extra mouthpieces or connexions. Thus Mr. West was driven to the immediate construction of such a drawing rake as he had contemplated for use with through retorts, and the result of his efforts had been explained.

The practical advantages of the new system in respect to production of gas per mouthpiece per diem, and per ton of coal, would be apparent when it was stated that the average make per mouthpiece on the old system was from 4000 to 4300 cubic feet during 24 hours, and the yield per ton 9800 cubic feet, while the make on the new system, with four-hour charges, was 5300 to 5400 cubic feet per mouthpiece, and the yield per ton 10,300 cubic feet; the coals being of the same description. The proportion of sulphide of carbon in gas made on the new system was found upon analysis, some time back, to be much less than in that made in the usual way.

Returns, which the author had been favoured with, by friends who were engineers of very large gas-works, using Newcastle coal, showed a yield per mouthpiece of 4500 cubic feet per 24 hours on the average; so that, taking the average on West's system as 5300 cubic feet, an advantage of nearly 18 per cent. in retort power was obtained. In other words, if the production rate were only 4500 cubic feet per mouthpiece, he would require 49 retorts at work on his system instead of 42, the number which he now employed, or he would need to supplement these 42 by a greater number on the old system than he now kept going.

It might be asked, why did not Mr. West work the whole 56 retorts which had been erected for use with his system? The reply was of the simplest. Fifty-six retorts were insufficient to meet the demand for gas, and as the retorts in the old house were "throughs," or double retorts, it answered better, with respect to labour, to work two benches, or 28 mouthpieces, than to work one bench, or 14 mouthpieces. In respect to yield per ton, this on the new system was 10,300 cubic feet, while on the old it was only 9800, showing an increased volume of 5 per cent. These results were obtained on the new system with moderate heats without any special effort, and in the ordinary every-day course of working. Holmside coals were used, without any cannel, and gas of from 15 to 16 candle illuminating power was produced. The author was aware that in some works, using Newcastle coal, fully 5000 cubic feet per 24 hours was made per mouthpiece, and 10,000 cubic feet per ton; but such results were only obtained with very high working heats and the use of a per centage of cannel coal, when it was necessary for the gas to be of 15 or 16 candle, or even of lower illuminating power.

The author regretted that, in respect to the money saving in labour, he was unable to give any absolute statement. The new system was not yet worked at Maidstone alone, the stokers being partially engaged on the old system. A few considerations, however, would suffice to show that a great economy was to be effected in this matter of wages saving. Those who were familiar with the details of manufacture, in works of about the size of those at Maidstone, were well aware that the make of gas for each man employed in the retort-house during 12 hours, including stoking, firing, wheeling, &c., was not more than from 21,000 to 22,500 cubic feet. At the present time the make per man on Mr. West's system was actually very nearly 27,000 cubic feet; and as against 22,500, this showed an advantage of 20 per cent. But the author was fully convinced that seven men and one boy in a gang would serve at least 84 retorts; and at the rate of 5400 per mouthpiece, the make of gas per man would be 30,000 cubic feet per 12 hours, being an increase of more than 33 per cent. On this basis, and at the London rate of wages, the cost per ton of coals carbonized, for all labour connected with the retort-house, amounted to 1s. 9d. The average cost in many much larger works was fully 2s. 6d. per ton. Here, then, a saving of 9d. per ton, or 30 per cent., would be effected. Again, as 5 per cent. more gas is obtained, there would be an actual saving of 4½ per cent. of coal; and at 18s. per ton the money value was a little over 9½d.

There yet remained for notice one other matter of profit—namely, the increased bulk of coke for sale. This increased bulk amounted to 8 per cent., and at an average sale price of 14s. per chaldron, the increased return on each chaldron would be little more than 1s., equal to 8d. per ton of coal carbonized, if, as on the ordinary system, a chaldron per ton and a 33 per cent. fuel account be taken as the basis of calculation. The author was aware that coke must possess considerable density when it had to be stacked and stored; but he entertained an opinion that if coke were generally produced of a somewhat lighter character, it would be found, as at Maidstone, more suitable for general use, and that the necessity for storing would, to a great extent, be obviated by the increased demand. The somewhat lighter coke took fire and burned almost as freely as coal itself, and was especially suited for domestic use.

The new system had been kindly taken to by the men, who did not now like the system of scoop-charging, and the work of charging and drawing was so much more readily done, that men unused to such kind of work became very quickly expert.

Touching upon the question of wear and tear of retorts, the author remarked it might be supposed that the running of the charger upon the retort floor would tend to produce channels, which, in time, would interfere very much with continued ease of working, and the delivery into the retorts of the proper weight of coals. The life or endurance of a clay retort was variously estimated. One authority fixed the duration at 2½ to 3 million cubic feet; but the author was quite of the opinion of his esteemed friend, Mr. E. S. Cathels, now engineer of the Montreal Gas-Works, that such a short duration was not indicative of good working. Another authority fixed the duration at three years, and this was much nearer the mark. Suppose a retort kept regularly at work during that period, and producing 5000 per diem, there would be, in round numbers, a total production of five million cubic feet. The retorts at Maidstone had been at work more than six months, and had produced in that time just upon one million cubic feet each, and there was scarcely an evidence, in the way of a mark even, upon the floor of any one, to indicate wear. They had done, according to the estimated duty, one-fifth of their work, and certainly appeared to be capable of doing much more than the remainder.

The author came lastly to deal with the question of the total commercial or pecuniary advantages of the new system. Assuming 84 retorts to be used, and, on the average, to be in active work during two-thirds of the year, each retort would carbonize 121 tons, with a saving of 9½d. per ton of coal, 9d. for labour, and 8d. for increased returns for coke. The account would, therefore, stand thus:—

121 tons at 9½d.		£4	15 9½
121 „ 9d. for labour		4	10 9
121 „ 8d. for coke		4	0 8
Making a total of		£13	7 2½
The patented apparatus, including fixed hopper, lifting gear, rails on floor, &c., will cost about £500, say £6 per mouthpiece, and 15 per cent. on this to cover interest, wear and tear, &c.	£0 18 0		
Estimated cost for breaking and hoisting 121 tons at 4d.	2 0 4		
		2	18 4
Leaving a possible net gain of		£10	8 10½

Multiplying this by 84, and there would be found a saving of £877 5s. 6d. on a carbonizing account of 10,164 tons of coal, a make (at 10,300 cubic feet to the ton) of 104,689,000 cubic feet, and a rental, after deducting 10 per cent. for leakage, of £18,845, with gas at 4s. In other words, the probable saving would be equal to 4½ per cent. on the rental. Assuming, however, that the economy would amount to only one-half the estimate, and sufficient still remained, in the author's opinion, to render the system an assured success.

The author said he had entered somewhat fully into the possible commercial advantages attending the use of Mr. West's system, because he felt that mere ingenuity in construction was not in itself sufficient to excite the lively interest of engineers. A machine might be very ingenious and very original, but if it does its work no better nor cheaper than the machines or appliances which had preceded it, it possessed little or no merit in usefulness, except in suggesting to active minds the direction in which improvements were to be found.

A vote of thanks having been given to Mr. Hartley for his paper, the Chairman invited discussions upon it.

Mr. H. W. Pendred said Mr. Hartley stated in one part of his paper that, according to an arrangement of the new system, when the retorts were open at both ends, there was a gradual cooling down of the retorts, which necessitated a considerable increase in the firing. He should like Mr. Hartley to explain why that cooling down took place. Was it from the influx of air into the retorts, or was it from radiation from the metallic doors at the end.

Mr. Eldridge remarked that gas managers had recently been told on high authority that, if they wished to spend a happy day, they must go to Maidstone. Acting on this advice by Mr. Spice, he had been to Maidstone and seen Mr. West's apparatus at work. From what he then observed he was fully convinced that it would produce all the interesting and profitable results which Mr. Hartley attributed to it. There were two facts, however, connected with it to which he thought not much prominence had been given by the writer. It would be remembered that Mr. Spice, in his pamphlet, spoke of the present system of stoking as one depending upon bones and sinews; and no one going into a retort-house could fail to observe that the employment of stokers was a most trying one. One of the chief features in the advantages of Mr. West's system of charging and drawing retorts was that the men were not so much exposed to heat as under the old method of stoking. Another advantage was, that its adoption would make the gas manager independent of skilled labourers—a most important matter. No one connected with gas-works but must feel at times very uneasy with reference to the labour question. But if the new system was brought into operation, and the stokers were disposed to get up an agitation, or refuse to work, the manager could put others into their place, because the apparatus did not depend upon skilled labour. He, therefore, trusted the invention would prove highly successful, and that the inventor would be fully rewarded for the skill and trouble he had bestowed upon perfecting its arrangements.

A Member asked whether this system of charging and drawing retorts was applicable to all shapes of retorts. At Maidstone it appeared to have been applied to the D shape only, which he thought were considered rather old fashioned. Yet it appeared to be better suited to that shape than others. It was rather surprising to him to find that the "charger," or carriage for the delivery of coals into the retorts, stood the heat so well as the specimen produced by Mr. Hartley proved that it did. It was formed of thin sheet iron, and appeared, notwithstanding the great heat to which it had been exposed, to have suffered no damage.

Mr. Trewby being called upon by the chairman, said that he was a visitor, and came seeking information only. He was very much pleased with the particulars furnished in respect to this apparatus, and his intention was to go to Maidstone and see it in actual operation. With respect to the observations just made as to the shape of retorts, it was now universally admitted by gas managers that the D-shape was the best. At the large works of The Gaslight and Coke Company at Beckton there were nearly 3000 retorts. At the commencement of those works they used large circular retorts, 18 inches in diameter. These had been replaced by D retorts, 20 inches wide and 18 inches deep, which were found to be the best that could be employed. Referring to the observations in the paper about the make "per mouthpiece," he would say that, he should like to be informed as to the make per superficial foot. The make per mouthpiece of his own retorts averaged 5200 or 5300 feet, and the make per ton 10,300

feet, so that in this respect he did not see that he could get much advantage by changing to the new system of charging. He had been particularly struck with Mr. Hartley's observations about the thin layer of coals in the retorts, and it seemed to him that in that, there was but little advantage got from the upper part of the retorts, and his own experience hitherto had been that he got as much carbonizing power from the upper as from the lower part. He should expect to find, with such thin layers of coal, the per centage of fuel would be much higher. He was always on the look-out for something to supersede hand labour, and, at the present time, his company had ordered one of Foulis's charging and drawing machines, which, in the course of about two months, he hoped to have in operation. If Mr. West's system should prove, in a few months, by an examination of the Maidstone Company's accounts, to be a superior machine, he had no doubt that his own, or some other of the London companies, would give it a trial. With respect to the formation of bisulphide of carbon, of which Mr. Hartley had spoken, he remarked that it was generally considered that the amount of that impurity was very large towards the latter part of the charge. Two or three years ago he (Mr. Trewby) made some experiments with reference to this, and was particularly struck by the fact that it was quite the reverse, and that its production occurred during the first hour. This experiment of his own was confirmed by one of his colleagues, who found, on charging up the whole of the retorts (it was the custom to stop work as much as possible on Sunday), and on putting the sulphur test to work, and working rapidly, he got the largest amount of bisulphide in the first two or three hours. As far, therefore, as his experience was concerned, the former theory was exploded.

Mr. C. Horsley asked whether he understood that the coal required to be broken up into very small pieces. If so, he was afraid there would be a great deal of dust produced, which might clog the wheels of the apparatus.

There being no time for further inquiries (a discussion upon another paper having occupied the earlier part of the meeting), the chairman now called on Mr. Hartley for a reply.

Mr. Hartley said he would take the questions put to him in reverse order. Mr. Horsley had inquired about the breaking up of the coal. This was required to be done before the coal was fed into the hopper, but it was evident tha the mere breaking up of the coal would not suffice to account for the increased yield. In making comparative trials, he resolved, and Mr. West agreed with him, that he would make them with coal exactly in the same conditions, whether the retorts were charged on the old or the new system—reduced as required by West's system. The advantage then, grew out of the distillation in a thinner mass. Mr. Trewby had answered the question which another gentleman put, as to the shape of the retorts, and therefore, he (Mr. Hartley) need say nothing about that. Mr. Trewby's large experience was a sufficient assurance that the D retort was the best. He entertained a hope, however, that a modification of Mr. West's system might make it applicable to retorts of all shapes presently. The retorts at the Maidstone works, to which this apparatus was applied, were 21 inches by 13 inches, and 9 feet long, and therefore the yield per mouthpiece he considered to be very respectable for that size. The retorts in use in the other house were 15 inches round, 20 feet long. Referring to Mr. Trewby's observation, that with these light charges there was no advantage derived from the upper surface of the retort, he remarked that the practical testing of the system at Maidstone proved that advantage was obtained by the use of thin layers of coal on the bottom surface of the retort, and he was compelled to suppose that it came from the communicated heat on the upper surface. The fuel account was much lower than in London, which came out 30 per cent.—it being not more than 22 or 23 per cent. at Maidstone. He was quite prepared for the observation about the production of bisulphide of carbon, and, when reading his paper, had remarked that his proposition had been disputed. In the course of his experiments with Mr. West's system, he determined to ascertain the amount of sulphur present as sulphide compounds, and his investigatious extended to round retorts worked on the old, as well as to D's worked on the new system. In the result he found 26 grains present in the one case, and in the other only about 12 or 13 grains. Mr. Trewby spoke also about the yield of gas at his works being 5300 feet per mouthpiece, and 10,300 per ton. He (Mr. Hartley) was not surprised to hear it. The standard of illuminating power for the Chartered gas was 16 candles, which, of course, meant at least 17, and an investigation of that company's accounts showed that they used 12 per cent. of cannel—a per centage far in advance of other metropolitan companies, for the simple reason, that the Chartered Company alone were makers of cannel gas. He did not know exactly how much cannel was used at Beckton; the 12 per cent. he had mentioned was, according to Mr. Field's book, the average per centage at all the stations of that company; whereas over all the London companies, excluding the Chartered, it was 2¼ per cent. At Maidstone no cannel was used. The advantage, therefore, which Mr. West's system afforded, of getting a high illuminating power, without the employment of cannel, must be evident to every gas manager. Mr. Eldridge's remarks were mainly a confirmation of the paper. He (Mr. Hartley) could not venture to enlarge upon the labour question, and the advantage, under this new system, of dispensing with the necessity for skilled labour; nor was it necessary, so far as Mr. Eldridge was concerned, for that gentleman had seen, and was convinced of, the superior advantages of the new over the old system. He might, however, express his conviction that, after assisting at two or three charges, a man taken from the street would be able successfully to manipulate this apparatus. Indeed, the diminution of labour by it was so great that he had himself drawn and charged a retort at Maidstone, which he certainly could not do by the old method. With regard to retorts opening at both ends, and the inquiry made as to the cause of the cooling which took place, it was a difficulty at first to determine the question, and to settle the point he closed up the back end of the retort, and held his hand there as long as he could bear it. He found in 32 seconds that the lid got too hot to keep his hand there, and in two minutes he could not touch it with his finger. This showed him that there was convection and radiation going on to a considerable degree. In addition to that he found that, on opening a retort, a circulation set through it immediately; an altogether different state of things prevailing when firing at each end, as when through retorts were used. But the mere radiation and convection alone must be so enormous as to bring the retorts down considerably lower in a single charge. He had seen this take place to such an extent that, at the fourth charge, it was impossible to work them.

The Chairman said the writer had mentioned that the coal required breaking. How small was it necessary to reduce it?

Mr. Hartley said, about the size of nuts.

The Chairman suggested whether it might not be advantageous therefore to screen some kinds of coal so as to get a good house coal, and use the smaller parts for gas making.

Mr. Hartley said this had been done to some extent.

The Chairman, in closing the discussion, said it appeared to him that the labour-saving arrangements effected by this apparatus, while extremely simple, were very important. Looking at the worn-out slipper exhibited by Mr. Hartley, he remarked that no one could doubt from its appearance that the work it was designed to do had been very effectually done.

Birmingham Water Supply.—With reference to the water supply to Birmingham during the month of November, Dr. Hill, the medical officer of the town, reports that it was slightly turbid, of a greenish-brown colour, and that the proportion of organic nitrogen was higher than at any previous time of the year,

IRON AND COAL TRADES OF SHEFFIELD, SOUTH YORKSHIRE, AND NORTH DERBYSHIRE.

(FROM OUR OWN CORRESPONDENT.)

In the iron trade of the town and district there has been some little renewal of steadiness apparent, although in respect of transactions in finished and general manufactured iron much dulness prevails in all, or nearly all departments.

Pig iron, however, has been steadily firm during the whole week, with an attendant considerable number of sales, many of which have been out of the district. No. 1 foundry is still 65s.; and No. 3, 62s. for good local makes. The coal agents of the North Yorkshire firms now quote about the following nominal figures for general makers brands:—No. 1 foundry, 54s.; No. 2 foundry, 52s., No. 3 foundry, 50s.; No. 4 foundry, 49s.; No. 4 forge, grey, 49s.; No. 5 forge; mottled, 48s. 6d.; No. 6 forge, white, 47s. 6d.; refined metal, 69s.; Kentledge, 57s. 6d.; and cinder pig, 39s. to 40s., all per ton, with the usual allowance for cash.

The brassfounders are not now quite so busy as they were a short time back, many of the storekeepers being unwilling to receive large consignments of goods at a period just anterior to the yearly stocktaking time.

The Dronfield Silkstone Colliery, and some other pits in the Derbyshire district, are flooded, consequently the Sheffield coal merchants have again advanced their prices by 1s. per ton. On Monday an awful explosion took place at the Swaithe Main pit of Messrs. Mitchell, Bartholomew and Tyas, near Barnsley, by which 150 or 160 persons were killed. Many of the bodies are yet in the working, and at present the cause of the accident is unknown, although it is supposed to have occurred owing to a blasting shot having been fired off in a new drift which was being driven in order to find the seam after a dislocation of the strata. The matter naturally created the most intense excitement in the district, many of the neighbouring collieries being subsequently laid off for several days. Taken as a whole, the coal trade is fairly active, especially in hard coal and best household qualities. Prices are very firm, but are not at present seriously dearer. The question as to shipping coal at Keadby is as yet unsettled.

IRON AND COAL TRADES OF SOUTH STAFFORDSHIRE AND EAST WORCESTERSHIRE.

(FROM OUR OWN CORRESPONDENT.)

The recently noted depression in the iron trade of this district is more strikingly manifest than last reported; indeed, business grows worse from week to week, and operations are now being rapidly curtailed in every department of the trade. Most of the mills and forges throughout the district are now running about half time only, and it is feared that some will be altogether closed unless an early revival of business is experienced.

A few makers of sheets and boiler plates of noted brands continue to find moderate employment, but in all other departments there is scarcely any business doing.

Prices are substantially unaltered, but the tendency is decidedly in the direction of ease. Rates are supported more by the firmness and scarcity of coal than by any other circumstance. Good sheets are readily obtainable at £10 15s. per ton, though the nominal quotation for leading brands still stands at £13; in like manner, bars of fair average quality are on offer at £7 15s., though the leading firms continue to quote £10. The few specifications now being placed are for iron for purely local consumption, and the prospect of a return to anything approaching a satisfactory demand appears to be remote.

In pig iron the market is greatly depressed, owing, for the most part, to the increasing competition of the north country districts, which is now very much affecting the producers of the commoner qualities of iron. Prices are again rather weaker, transactions in cinder pig being recorded at £2 17s 6d. per ton; but good native brands are moderately steady at £4 10s. to £4 15s. per ton. The total number of furnaces in the South Staffordshire and East Worcestershire district is 149, and of these 68 only are now in blast, and it is estimated that the output of pig iron is now 6000 tons per week less than it was in 1872. Notwithstanding this, preparations are now in progress for still further reducing the make.

In the coal trade there is considerable activity in respect of household qualities, and in the Cannock Chase district the pits are in full operations around Dudley and West Bromwich. Best thick coal is also in demand, and prices are well suported; but in the Tipton and Bilston districts operations have been suspended at many of the collieries, in consequence of the flooding of the mines, and the whole mineral area of that part of the district is now threatened with inundation by the stoppage of the pumping-engines of Messrs. S. Groncutt and Sons, upon whom the burden of drainage has lately fallen rather heavily, and who now decline to keep their engines in operation unless assisted by the Mines Drainage Commissioners or the neighbouring mineowners, and at present the required help is not forthcoming. Prices for manufacturing coal are consequently firmer than last reported, and much temporary inconvenience is experienced by the diminished supply of fuel. Coke is generally slow of sale, and prices are in favour of the buyer.

THE LANCASHIRE COAL AND IRON TRADES.

(FROM OUR OWN CORRESPONDENT.)

For gas coal there has been a pretty good demand during the week, both for the supply of old contracts and on account of new business. In one or two quarters there has been a partial stoppage of the canal traffic by the recent frosts, and as this has interfered with the regular deliveries to gas-works, there has been a little extra push for temporary supplies. Prices remain firm at about late rates, good screened gas coal at the pit's mouth in the Wigan district being quoted at from 12s. 6d. to 13s., and nuts at about 11s. per ton.

For coke there is still only a very poor inquiry, and prices are irregular, depending greatly upon the arrangements made between buyers and sellers in the few transactions that do take place.

The iron trade of this district continues very quiet, and, notwithstanding the increased prices that are being asked for Middlesbrough pig iron, buyers do not come forward with any freedom, as founders and manufacturers in many cases seem to think the advance will only be temporary. Local makers are doing a little more business, as they are now more on a level with the market quotations for other brands, but they are still confining their make to about half their proper production. The average quotations for Lancashire pig iron, delivered in the Manchester district, are about 62s. 6d. for No. 3 foundry, and 61s. for No. 4 forge. Middlesbrough iron for prompt delivery in this district is quoted at 58s. 9d. for No. 3 foundry, 57s. 9d. for No 4 foundry, and 57s. 3d. for No. 4 forge, with a trifle less for forward delivery. Manufactured iron continues weak, and orders come to hand very slowly. Quotations are about the same as those last given. Middlesbrough bars delivered being £7 15s., Lancashire £7 17s. 6d., and Staffordshire £8 per ton.

THE COAL AND GENERAL TRADE OF THE NORTH OF ENGLAND.

(FROM OUR OWN CORRESPONDENT.)

The rates paid to steam tonnage for London and other ports were lower last week. Orders for small cargoes of gas and household coals continue to accumulate, and they will increase until we have a fleet of light sailing vessels, when they will be rapidly cleared away. The best household coals are very firmly held. The price of best gas coals is also fully sustained, and the colliery offices seem disposed to prevent any accumulation of stocks at the pits. One or two of the best collieries have restricted the output, with that object apparently. They seem inclined to force the price of best gas coals above the present quotation of 11s. per ton, but they are hardly likely to succeed, in consequence of the abundance of second-class coals of all sorts which are in the market. Second-

class Durham steam and manufacturing coals are excessively low, and the collieries producing them are very keen of entering upon business at almost any price. The best Northumberland steam coal trade is likewise flat, and a good deal of broken time continues to be made at these pits.

There is a delay in the shipment of fire-bricks and other manufactured goods from the Tyne, in consequence of the continued detention of light sailing vessels. The manufacturing business of Tyneside is very depressed. The chemical trade is getting worse, and there seems little prospect of any improvement of manufacturing industry in this district until the turn of the year.

TRADE NOTES FROM SCOTLAND.

(FROM OUR OWN CORRESPONDENT.)

At the annual meeting of the Inverkeithing Gaslight Company, Limited, it was resolved that the usual dividend to shareholders of 5 per cent. be declared; and at the same time it was agreed to reduce the price of gas to the consumers to 9s. per 1000 cubic feet for the present.

The Police Commissioners of Milngavie have resolved on erecting cast-iron lamp-pillars throughout the burgh, and have accepted an offer to supply and erect the same, with globes, &c., complete, at a cost of £2 2s. each.

At a meeting of the Town Council of Edinburgh, held on the 30th ult., there was laid on the table an analysis made by Mr. J. Falconer King, public analyst, of the gas supplied to that city. The examination and analysis, which were made on the preceeding Thursday and Friday, showed that the gas supplied by the Edinburgh Company was of an average illuminating power of 29·75 expressed in standard candles; that ammonia was distinctly present, but that there was no hydrosulphuric acid. The gas supplied by the Leith Company gave an average illuminating power of 26·30 standard candles, while in it also there were traces of ammonia, but none of hydrosulphuric acid.

During the week there has been an advance in the price of makers iron, some brands to the extent of 6d. per ton, others 1s. per ton. On two or three days there was a good deal of firmness, and the price of warrants ran up to 63s. 7½d. per ton cash, and 63s. 9d. one month open. On Friday afternoon the closing prices were, sellers 63s. 4½d., buyers 63d. 3d.

The coal market has been firm during the week, with a steady demand for house and shipping coal. The demand for local consumption has been increased by the severity of the weather, but there has been no material or general advance in price.

The GRAND MEDAL of MERIT at the VIENNA EXHIBITION has been AWARDED to

GWYNNE & BEALE'S PATENT IMPROVED GAS-EXHAUSTERS,

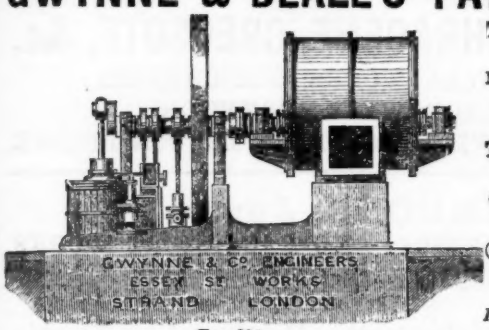


FIG. 224.

The BEST EXHAUSTERS IN THE WORLD.

Made under the personal superintendence of

Mr. BEALE,

The oldest Maker, Inventor and Patentee of

GAS-EXHAUSTING MACHINERY.

(It is NOT CORRECT to state that Mr. BEALE has RETIRED.)

Prices and every information on application.

FIG. 225.

Fig. 224 represents one of those erected at the Imperial Gas-Works, Bromley, capable of passing 210,000 cubic feet of gas per hour. Several others of the same size are now on order for the same Company. These Patent Machines combine the highest quality of workmanship and materials, the largest bearings and wearing surfaces, with the most perfect system of action yet discovered. Fig. 225 represents one of a series of four at the Nottingham Gas-Works, each passing 52,500 cubic feet per hour. GWYNNE AND Co. *do not pretend to enter into a struggle with other makers in respect to cheapness. They have never sought to make price the chief consideration, but to produce Machinery of the very highest quality, and the most approved design and arrangement.* Their prices have been estimated with a due regard to the excellence of the article produced, and when this is taken into consideration, they have no fear for the result. The orders executed this season for Exhausters and alterations to their patented system amount to over 4,000,000 cubic feet of gas passed per hour, and to over 300 horse power for Engines to drive them. In every instance their work is giving the greatest satisfaction. Numerous testimonials and references can be given.

REGULATORS, BYE-PASSES, STOP-VALVES, GAS-VALVES, & MACHINERY FOR GAS MANUFACTURE, OF ALL SIZES,

CAN BE HAD ON APPLICATION TO

GWYNNE & CO., HYDRAULIC & GAS ENGINEERS, ESSEX STREET WORKS, STRAND, LONDON, W.C.

G. & Co. are now manufacturing for a London Gas Company three of their 210,000 cubic feet Patent Gas Exhausters, and many of all sizes.

D. BRUCE PEEBLES & CO.,

ENGINEERS,

FOUNTAINBRIDGE WORKS, EDINBURGH,

MANUFACTURERS OF WET AND DRY GAS-METERS;

Patentees and Sole Manufacturers of PEEBLES' LAMP-GOVERNORS,

ABOVE 30,000 OF WHICH ARE NOW IN USE.

"These Lamp-Governors are so superior that they are likely to supplant all others."—*Dr. Wm. Wallace, F.R.S., F.C.S.*

D. BRUCE PEEBLES AND CO., FOUNTAINBRIDGE WORKS, EDINBURGH.

WANTED, an experienced Main and Service Layer.

For particulars apply to the MANAGER, FORFAR GAS-WORKS.

WANTED, by a young Man, a situation as CLERK or Collector, or Assistant Manager in a Gas-Work. Well acquainted with keeping Gas Companies Accounts and Collection of same. Good references.

Address No. 226, care of Mr. King, 11, Bolt Court, FLEET STREET, E.C.

WANTED, the Management or Assistant Management of a Gas-Work. Five years practical experience in the manufacture and distribution of gas.

Address No. 214, care of Mr. King, 11, Bolt Court, FLEET STREET, E.C.

WANTED, by a thoroughly practical Man, a situation as WORKING MANAGER or Foreman of small Gas-Works. Has been used to working exhausters and the general work of a gas plant. Aged 33. Highest references given.

Address R. K., 155, CHEAPSIDE, E.C.

WANTED, by the Advertiser, a situation as CLERK, Collector, or Assistant Manager in a Gas-Work. Well up in Gas Companies Accounts. Good reference, or personal security if required.

Address No. 216, care of Mr. King, 11, Bolt Court, FLEET STREET, E.C.

BEALE'S EXHAUSTER.

WANTED immediately, a Beale's EXHAUSTER, in first-rate condition, to pass from 40,000 to 60,000 cubic feet per hour.

Particulars and lowest price to be forwarded to GEORGE BOWER, St. Neots, HUNTS.

WANTED, by the Advertiser, who has been articled to the Gas Engineering, a situation as MANAGER or Assistant Engineer of a Gas-Work. Is a first-rate draughtsman. Can test and analyze gas. Has had ten years experience in the manufacture and distribution of gas. Unexceptionable references produced.

Address No. 228, care of Mr. King, 11, Bolt Court, FLEET STREET, E.C.

CORPORATION GAS-WORKS, ABERAVON, SOUTH WALES.

WANTED, a thoroughly competent FOREMAN or Working Manager for the above works, who understands the manufacture and distribution of gas, retort-setting, and gas-fitting.

Apply, stating salary expected, and with copy of testimonials, to the TOWN-CLERK, Aberavon, SOUTH WALES, on or before Monday, Dec. 27, 1875.

NEW EDITION, NOW READY,

ADVANTAGES OF GAS FOR COOKING AND HEATING.

By MAGNUS OHREN, A.I.C.E., F.C.S.

For Companies to issue to their Gas Consumers.

Specimen Copy by post Threepence, direct from MAGNUS OHREN, Gas-Works Lower Svdenham, London, S.E.

TO IRONFOUNDERS.

THE Keighley Local Board of Health is prepared to receive TENDERS for the supply of about 1800 yards of Cast-Iron PIPES, 16 in. diameter.

Particulars can be obtained on application to the undersigned, at the Gas-Works, Low Bridge, to whom tenders must be delivered, before Monday, the 27th inst., endorsed "Tender for Pipes," and addressed to the Chairman of the Gas-Works Committee.

The lowest or any tender not necessarily accepted.

By order,

JOHN LAYCOCK.

Keighley, Dec. 3, 1875.

STOKING MACHINE PATENT FOR SALE; undoubtedly one of the simplest and most effective machines of the kind invented.

Apply, by letter only, to No. 224, care of Mr. King, 11, Bolt Court, FLEET STREET, E.C.

STATION-METER for Sale, in good condition (Makers West and Gregson) in very ornamental case, fitted up with tell-tales, inlet, outlet, and bye-pass valves, and 12-in. connexions. Passes 25,000 cubic feet per hour. Now replaced with a larger one.

For price, &c., apply to JOHN W. WHITAKER, Manager, Gas-Works, WAKEFIELD.

TO GAS & WATER COMPANIES, & MUNICIPAL AUTHORITIES SUPPLYING WATER OR GAS.

CONSPIRACY AND PROTECTION OF PROPERTY ACT, 1875.

It is required, under a PENALTY OF FIVE POUNDS, that a PRINTED COPY of the 4th SECTION of the above Act shall be posted up at all Gas and Water Works in a conspicuous place, where the same may be conveniently read by the persons employed thereat.

Printed copies of the section, in large type, on broad sheets, may be had of WILLIAM B. KING, 11, Bolt Court, Fleet Street, LONDON. Price, per post, 2s. per dozen, or 10s. 6d. per 100.

The Act came into operation on Sept. 1, 1875, and extends to Scotland and Ireland.

NOTICE TO THE PUBLIC.

BRONNER'S IMPROVED SYSTEM IN GAS LIGHTING.

MESSRS. HENRY GREENE AND SON, 155, CANNON STREET, LONDON, sole consignees for Great Britain and Ireland of BRONNER'S IMPROVED SYSTEM IN GAS LIGHTING, beg to inform the public that JULIUS BRONNER, of Frankfort-on-Maine, in the Kingdom of Prussia, Manufacturer, has, of this date, 9th of November, 1875, obtained interdict before the Court of Session in Scotland, against R. M. Brechin and Company, Gas-Fitting Manufacturers, 46, Hanover Street, Edinburgh, and R. M. Brechin, the only known partner of the said firm, interdicting, prohibiting, and discharging the said R. M. Brechin and Company and R. M. Brechin from in any way advertising or offering for sale, or selling, or from in any way causing to be advertised, or offered for sale, or causing to be sold as "Brönner's Burners," any burners not manufactured by the said Julius Brönner, or from in any way endeavouring to induce the public to believe that the said R. M. Brechin and Company, or R. M. Brechin, sell or keep for sale "Brönner's Burners" manufactured by the said Julius Brönner, while such is not the case.

Further, the said Julius Brönner, on the 20th of April, 1875, in a suit in Chancery, 1874, B 365, instituted by him against a defendant who had been selling such Burners, obtained an injunction perpetually restraining the defendant, his agents, servants, and workmen, from in any way advertising or offering for sale, or selling, or from in any manner causing to be advertised or offered for sale or sold as "*Real Bronner*," or "Brönner," or "Broehner" Burners, any Burner not manufactured by or for the plaintiff, Julius Brönner, or by his agents.

WANTED, GAS-WORKS TO LEASE.

THE Engineer of a Work of acknowledged repute is desirous of LEASING a small work. Can offer unusual advantages to companies or proprietors whose undertakings are unremunerative, or have fallen into a dilapidated condition.

Address No. 202, care of Mr. King, 11, Bolt Court, FLEET STREET, E.C.

THE Advertiser, a married Man, aged 30, is open to an engagement as Outdoor SUPERINTENDENT, Inspector, &c., or as Manager of Gas-Works making 10 or 12 million feet per annum. Thoroughly conversant with the manufacture of gas, and the general duties of a Manager, and can be well recommended by several engineers.

Address F. RUSSELL, Manager, Gas-Works, ILFRACOMBE.

GAS-WORKS TO BE LET.

TO BE LET, on Lease, for a term of years, the Lower Gornall Gas-Works, Staffordshire.

The works are situated in a very populous neighbourhood, are fitted up with every requisite, are in full operation, and the make of gas and the number of consumers are steadily increasing.

Possession may be had on the 1st of January next, when the present lessee's term expires.

Apply to Mr. F. KENNING, Secretary, District Gaslight Company, Limited, 21, Darlington Street, WOLVERHAMPTON.

THE "Compagnie Genevoise de l'Industrie du Gaz" are prepared to receive OFFERS for the erection of a single GASHOLDER, capacity 20,000 cubic feet, diameter 40 feet, depth 17 feet, in next summer, at its Gas-Works of Mentone, Department Alpes Maritimes, France.

Tenders, indicating price, including columns and girders, to be directed to M. CHANTRE, Engineer of the Company, Gas-Works of Bologna (ITALY).

TO COMPANIES PROPOSING EXTENSION OF WORKS AT HOME OR IN THE COLONIES.

J. C. SELLARS respectfully calls the attention of such of his patrons who are Engineers and Managers of Gas-Works, also Architects and Builders, to his system of building with HARDENED SHELL-STONE BLOCKS, as forming, when "filled in," the neatest, strongest, most durable, and economical buildings ever introduced. The Blocks have a hard smooth stone appearance; their size is 18 in. in length, 9 in. in depth, and, as may be desired, 9 in. or 14 in. in width.

To show their cheapness, any clay brick wall costs 8d. per yard on each side for common plastering, that equals 16d.; and these thin Shell-Stone Blocks can now be moulded by a hand-block press as smooth on each side as the best common plaster, for 20d. per yard, and a modification of them for 16d. per yard (the price of the plastering), out of which I allow the ordinary labouring man 6d. per hour for moulding them (8 Blocks), and charge the cement at 50s. per ton, whereas London cement can be bought in cargoes at 32s. per ton, and could be made for less. If, then, you only purchase stones and cementing material (recommended for outside walls), or common mortar and stones, or even burnt clay bricks, laid within the cases and grouting (for inside walls), you obtain walls at a less cost, with the great advantage of the appearance of Ashlar stone buildings, in return for your patronage of the system. But please note the saving where stones are plentiful, or clean hard rock obtainable; and when these fail, if you are on the coast, you have shore sand, which, with hydraulic lime or Portland cement, is suitable for "filling in." In addition, when manufacturing the Blocks, by coating the weather side of the Blocks for the outer wall with a thin film of pure cement, and laying a "damp course" of cement in the foundation Blocks, you can render the wall so absolutely impervious to rain that not one gallon of water would be absorbed in the whole frontage of a house. Brick-setters are the best class of men for laying the Blocks speedily and accurately.

The Advertiser respectfully presents this business as being probably the most paying business of the day to those who have a moderate capital. It should always be remembered that cemented walls of a one-stone character being in most districts much cheaper than the same thickness of clay brick walls, are yet equal in strength and value to walls of bricks and mortar at least half as thick again—namely, 9 in. to 14 in., and as stone dressed on one side and plastered on the other for outside walls, and as plastered on both sides for inside walls. A hand press will turn out at least one super yard of wall (8 Blocks) per hour, and a press with one mould will be lent for a period of six months for the sum of £100, including royalty on the building in any district where I cannot give the address of a licensee. Where river sand is suitable, by taking a press, Portland cement, lime, and a man, Blocks may be made the same day, and afterwards a building be constructed equal in neatness and for health to the best London houses. Where sandstone (red or yellow) exists, that may be crushed for 3s. per ton. To prove the genuine character of the business, I will undertake to pay the train expenses of any Engineer or Manager with whom I may do business in my cement, now or at any previous time, who may favour me with a visit to my office and works, if he says at the time of inspection he is dissatisfied, and that the Blocks are not all that I advertise. I would, with pleasure, by appointment, show him the full series of weather-exposed bricks, Blocks hardened and not hardened, cement-coated, free, &c.; also an unstayed section of a 14-inch wall, one block in width and 14 ft. 6 in. in height, which has been exposed to the gales and frost of this winter, yet without a flaw—a feat of strength of structure that could not be shown with clay bricks and mortar.

The system is admirably suited for country places as well as most towns and the Colonies. Representatives of each of the following papers were at my office:—

Builder's Weekly Reporter, Sept. 24, 1875.—"Nothing can be better than these Blocks. To Builders the great advantages of this invention of Mr. Sellars must be apparent."

Building News, Aug. 20, 1875.—"The advantages to be derived from the system of Mr. Sellars are greater strength of material, compactness, rigidity, sanitary cleanliness, inasmuch as the moulded Blocks present smooth, hard, and stone-coloured surfaces."

Pamphlet on Application.

J. C. SELLARS, 2, FERRY BUILDINGS, BIRKENHEAD.

200 BRITISH AND FOREIGN TESTIMONIALS.

SELLARS' RETORT CEMENT (No. 1), 12s. per cwt.

SELLARS' FURNACE CEMENT (No. 2), 9s. per cwt.

All orders direct to J. C. SELLARS, the Gas Cement Works, BIRKENHEAD.

JOHN HALL AND CO., STOURBRIDGE,

Manufacturers of FIRE-BRICKS, LUMPS, TILES,

AND EVERY DESCRIPTION OF FIRE-CLAY GOODS.

N.B.—A Stock of 15 and 16 in. CIRCULAR RETORTS always on hand. Other kinds made to order on short Notice.

MESSRS. JOHN BETHELL & CO.,

(ESTABLISHED 1836,)

CONTRACTORS for GAS TAR,

MAKERS OF ANTHRACENE, CREOSOTE, &c.,

CLAYTON CHEMICAL WORKS, MANCHESTER;

SWAN VILLAGE, WEST BROMWICH.

Head Offices: 38, KING WILLIAM STREET, LONDON BRIDGE.

B. GIBBONS, JUN.,

DIBDALE FIRE-CLAY, BRICK, AND GAS-RETORT WORKS,

STOURBRIDGE (Established 1834),

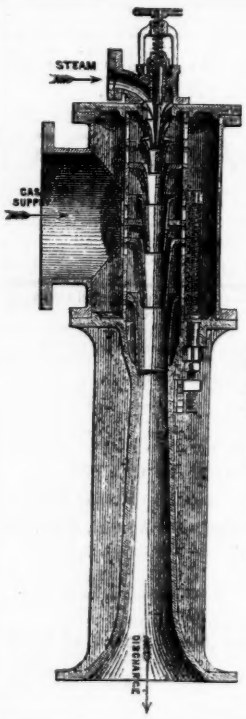
MANUFACTURER OF EVERY DESCRIPTION OF

Burs, Lumps, Stays, Shields & other Bricks, & Gas-Retorts,

A LARGE QUANTITY OF RETORTS ALWAYS IN STOCK.

Circular .	14 in.,	15 in.,	16 in.,	18 in.
Ovals . .	17 in. × 14 in.,	17 in. × 15 in.,	20 in. × 15 in.,	21 in. × 15 in., &c.
D's. . .	14 in. × 14 in.,	15 in. × 12 in.,	15 in. × 13 in.,	17 in. × 14 in., 18 in. × 13 in.
	18 in. × 15 in.,	20 in. × 16 in.,	22 in. × 14 in.,	24 in. × 14 in., 24 in. × 15 in., &c.

Special attention given to the execution of Export Orders.



KÖRTING BROTHERS,

SOLE LICENSEES FOR

W. CLELAND'S PATENT STEAM-JET GAS-EXHAUSTER.

E. KÖRTING'S PATENT

STEAM-JET GAS-EXHAUSTER.

Small Cost—Compactness—Perfectly Self-Acting—Self-Regulating—Self-Cleansing—No Steam-Engine—No Attention—No Extra Room Required—No Wear and Tear—No Noise—No Oscillation in Vacuum, or Back Pressure.

UPWARDS OF 150 IN USE IN CONTINENTAL GAS-WORKS.

IN ENGLAND SUPPLIED TO—

Chartered Gas Co., London; London Gaslight Co., London; South Metropolitan Gas Co., London; Phœnix Gas Co., London; Liverpool Gas Co., Linacre; Corporation Gas-Works, Bolton; Cornholme District Gas-Works; Epsom and Ewell Gas Company; Horsham Gas Company; Gaslight Company, Ipswich; Gaslight and Coke Company, Cheltenham.

E. KÖRTING'S PATENT STEAM-JET REVIVIFYING BLOWERS FOR THE PURIFYING MATERIAL.

W. CLELAND'S PATENT STEAM GAS-SCRUBBER,

Combining small cost and thorough efficiency, with absence of any mechanical means and necessity of renewing the scrubbing material.

For particulars, apply to **KÖRTING BROTHERS,**

STEAM-JET ENGINEERS,

7, LANCASTER AVENUE, MANCHESTER.

CELLERSTR. 35, HANNOVER, GERMANY.

KOLOWRATRING, PESTALOZZIGASSE 6, VIENNA.

11, RUE LOUIS-LE-GRAND, PARIS.

1645, NORTH TENTH STREET, PHILADELPHIA, U.S.

KÖRTING BROTHERS,

STEAM-JET GAS-EXHAUSTERS AND REVIVIFYING BLOWERS FOR OXIDE.

LONDON AGENT AND AGENT FOR SOUTH OF ENGLAND:

GERALD J. TUPP, 8, John Street, Adelphi, W.C.,

To whom all inquiries for these districts should be addressed.

DEMPSTER, MOORE, & CO., 49, ROBERTSON ST., GLASGOW,

SOLE AGENTS IN SCOTLAND FOR KÖRTING BROTHERS.

ALFRED WILLIAMS,

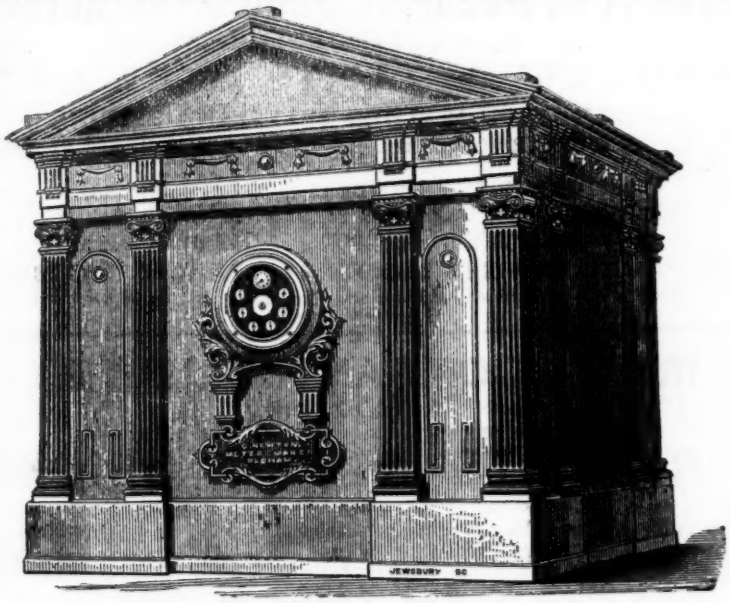
PHŒNIX FIRE-BRICK WHARF,

64, BANKSIDE, SOUTHWARK, LONDON, S.E.

GAS ENGINEER AND CONTRACTOR FOR THE ERECTION OF GAS-WORKS,
AND FOR THE
SUPPLY OF RETORTS, FIRE-BRICKS, CAST-IRON MAINS,
AND ALL MATERIALS FOR GAS MANUFACTURE AND DISTRIBUTION.

GEORGE NEWTON,

UNION STREET WEST, OLDHAM,



MANUFACTURER OF
SQUARE STATION-METERS, with PLANED JOINTS;
ROUND STATION-METERS, WITH CAST-IRON STANDS;
WET AND DRY CONSUMERS GAS-METERS, GOVERNORS, &c.

SAM. CUTLER & SONS,

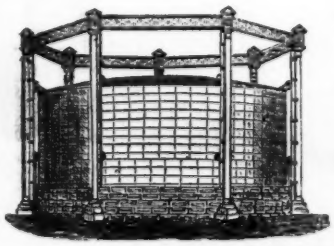
CONTRACTING GAS ENGINEERS,

GASHOLDER & GENERAL GAS APPARATUS MAKERS,

MANUFACTURERS OF

BOILERS, IRON ROOFING, IRON BRIDGES,

AND GENERAL IRONWORK.



S. C. AND SONS undertake Contracts of any magnitude for the **Erection of new and Remodelling of existing Gas-Works**, for **Gasholders, Cast and Wrought Iron Tanks, Iron Roofs**, and every description of **Apparatus** for the Manufacture and Distribution of Gas.

Special attention is invited to their **"Improved Condenser,"** which is very effective, and much approved; also to their patterns of **Annular** and other **Condensers, Scrubbers,** and **Purifiers,** of all sizes, which they arrange either with **Centre** or Ordinary **Slide Valves.**

WORKS FOR THE SUPPLY OF
VILLAGES, MANSIONS. FACTORIES, &c.

S. C. AND SONS undertake the **Supply** and **Laying** of **Mains** for **Gas and Water,** and supply all Castings, Connexions, and Fittings for Retort-House, Works generally, and for Streets. They also supply **Valves** of all descriptions, Iron and Clay Retorts, Hotpressed Retort-Lids, Steel Charging-Scoops of improved make, for which they have special machinery, Improved Coke and Coal Barrows, Cross-Bars and Screws, Bolts and Nuts, Furnace and Stoking Tools, Iron and Wood Purifier-Sieves, Lead, Yarn, Borings, &c., including every requisite whatsoever for a Gas-Work, a well-assorted stock being kept of those goods most in request.

SOLE MAKERS OF BRETT'S PATENT COKE BARROW.

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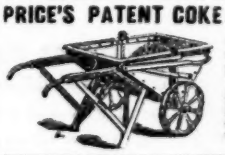

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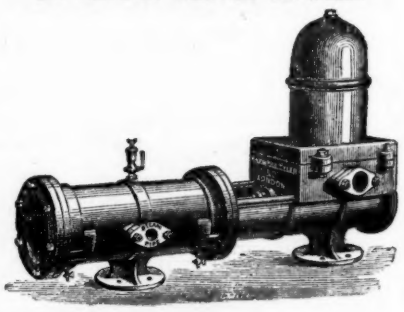

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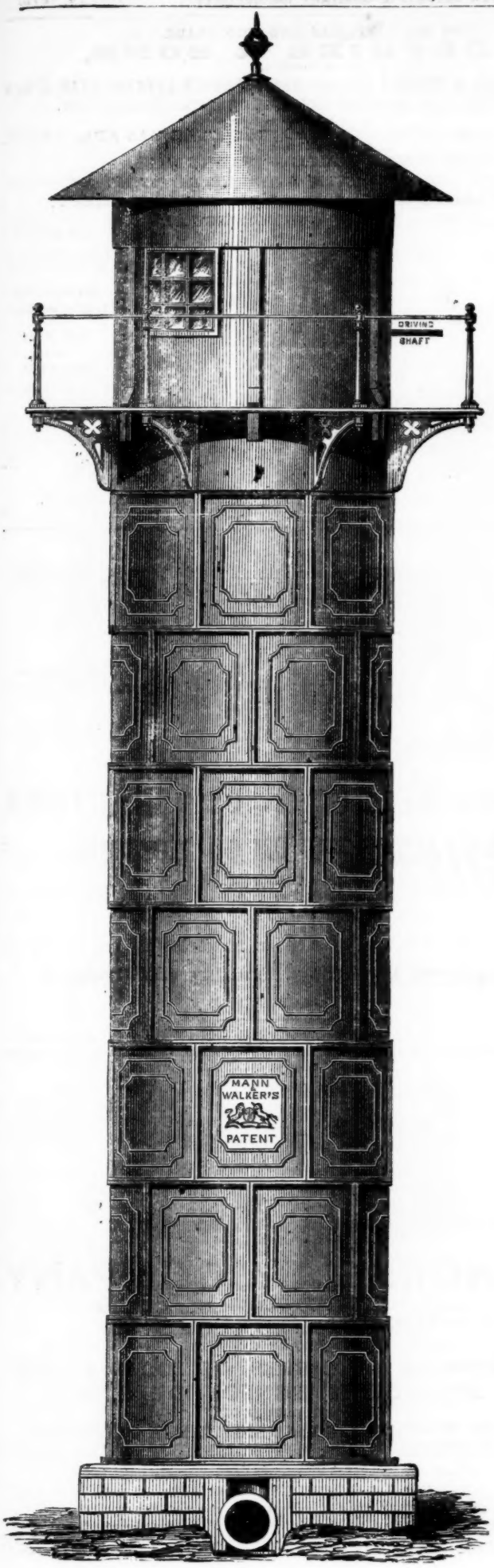

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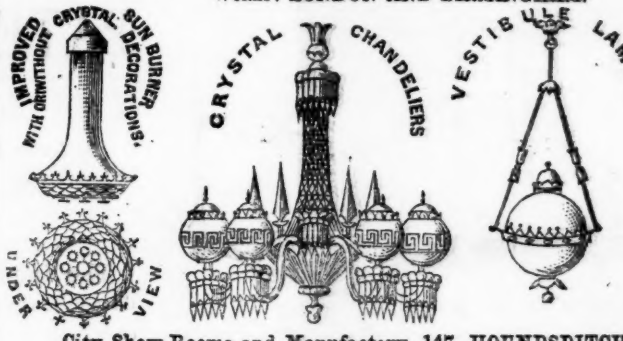

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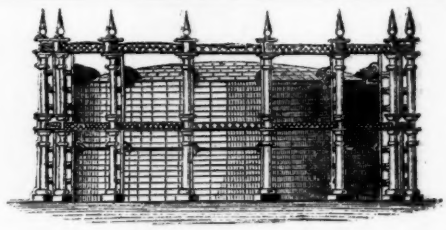

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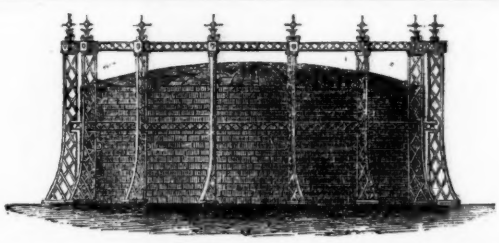

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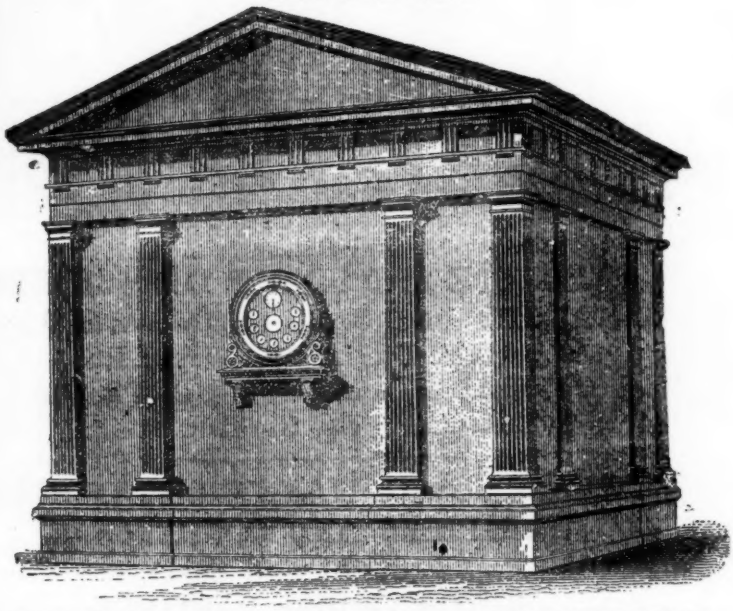

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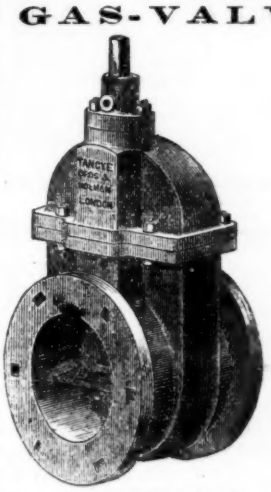

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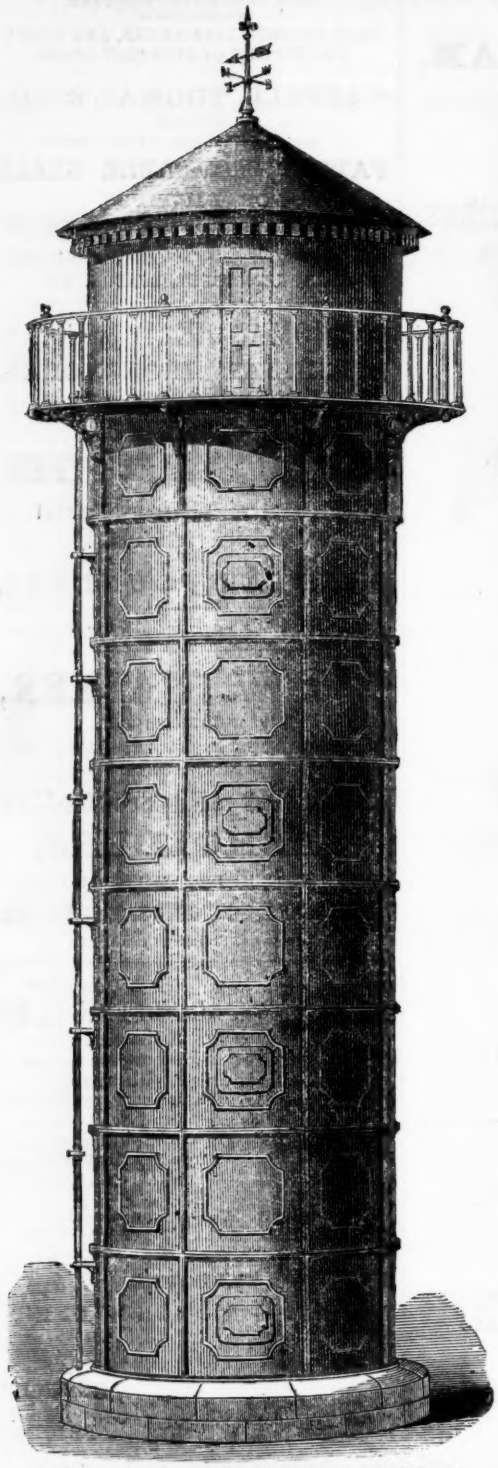

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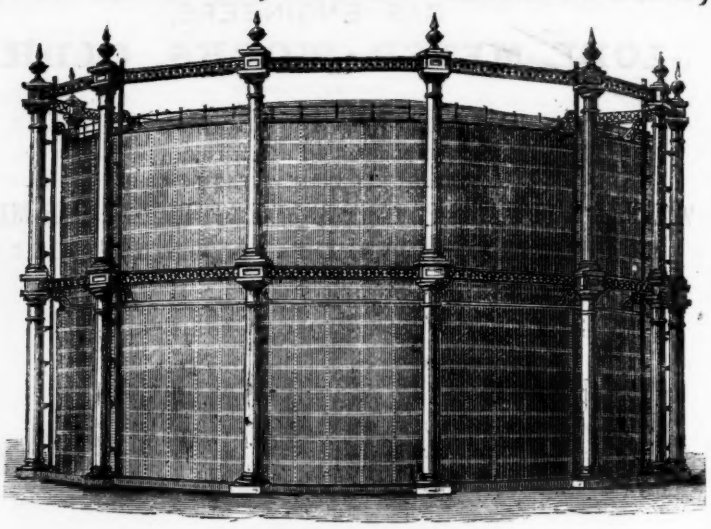

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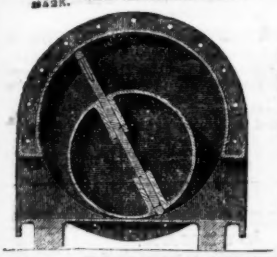
CHANDELIERS, &c., GAS-FITTERS' TOOLS, GAS TONGS, STOCKS, TAPS, DIES, &c., &c.,
HANDRAIL TUBINGS, IRON AND BRASS, PLAIN OR TWISTED,
TELEGRAPH TUBES OR POLES, &c., &c.

J. BEALE'S PATENT GAS EXHAUSTER.



BEALE'S CONTINUOUSLY ACTING

GAS EXHAUSTERS

ARE NOW MANUFACTURED BY

B. DONKIN & CO.

MR. J. BEALE, of East Greenwich, having retired from business, has made an arrangement with B. DONKIN & CO. for the sole manufacture of his Patent Solid-Slide Gas Exhausters.

B. D. & Co. also make Steam-Engines to drive Gas Exhausters direct or otherwise, and Gas-Valves.

Estimates and Prices on application to

B. DONKIN & CO.,
ENGINEERS & IRONFOUNDERS,
55a, BLUE ANCHOR ROAD, BERMONDSEY,
LONDON, S.E.

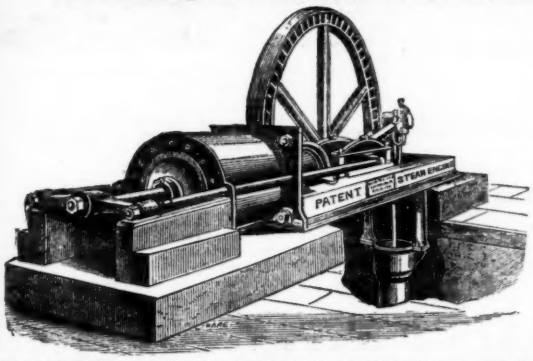
ECONOMY OF FUEL IN STEAM-ENGINES.

B. DONKIN & CO.,

PATENT HORIZONTAL COMPOUND CONDENSING

STEAM-ENGINES,

APPLICABLE FOR DRIVING GAS-EXHAUSTERS.



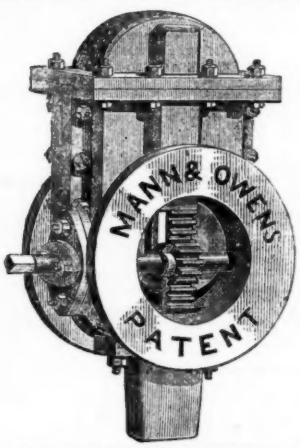
These Engines have been at work a sufficient number of years to prove their durability and efficiency.

One of them has been subjected to a scientific and exhaustive trial to test the consumption of fuel, with the result that an expenditure of less than **2 lbs.** of coal per hour developed one indicated horse power.

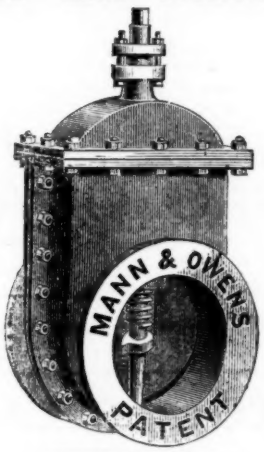
Full Details of this Trial, and Prices, sent on application to

B. DONKIN & CO., 55a, BLUE ANCHOR ROAD, BERMONDSEY, LONDON, S.E.

MANN & OWENS' PATENT GAS-VALVE.



RACK AND PINION VALVE.



SCREW VALVE.

The advantages of this Patent Valve over all others yet introduced are, that it is always as tight as the best wedge or spring valve, without the possibility of setting fast or becoming suddenly leaky. The surfaces not being in contact during the operation of opening or closing, leakage through wear and tear is avoided.

The Gas Engineer will not fail to see the importance of such a valve in connexion with his purifying apparatus, particularly in the case of large sizes.

The slide being operated either by a screw and nut, or by a pinion and rack, a cam bearing upon a plane, cast on the back of the Valve, forces it against the face, and renders the escape of gas an impossibility. By a slight turn of the pinion or screw, the slide is released, and brought away from the face, by which means friction is avoided, and the only force required to open the Valve is that due to its own weight.

SOLE MANUFACTURERS:

S. OWENS AND CO.,

HYDRAULIC AND GENERAL ENGINEERS,

WHITEFRIARS STREET, LONDON, E.C.

PRICES, SIZES, AND FULL PARTICULARS ON APPLICATION.

THOMAS CARR & SON,

MANUFACTURERS OF

FIRE-BRICKS, LUMPS, TILES, RETORTS, &c., &c.,

SCOTSWOOD FIRE-BRICK WORKS,

SCOTSWOOD-ON-TYNE.

THOMAS LAMBERT & SONS

MANUFACTURE EVERY DESCRIPTION OF

GAS AND WATER FITTINGS;

ALSO,

WROUGHT-IRON TUBES & FITTINGS.

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Manufacturers of GAS-RETORTS, GLASS-HOUSE FURNACE & BLAST-FURNACE BRICKS LUMPS, TILES, and every description of FIRE-BRICK.

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And Every Description of Best Fire-Bricks.

ALPHA PATENT PORTABLE GAS-MAKING APPARATUS,

NOW MADE WITH

SELF-FEEDING ARRANGEMENT.

Specially constructed for Country use.

No. 2 . . . 25 lights, £30.
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Larger and smaller sizes in course of construction.

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"SELLARS' CEMENT"

PREVENTS WASTE OF GAS FROM RETORTS;

SAVES CLAY RETORTS FROM DESTRUCTION BY FIRE;

GREATLY ECONOMIZES THE USE OF FIRE-BRICKS;

And PREVENTS ALL POSSIBLE LOSS of GAS FROM LEAKAGE.

J. C. SELLARS,

THE GAS CEMENT WORKS,

BIRKENHEAD.

LAMP-PILLARS,

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Our New and Choice Designs for the above, with prices, are forwarded to any part of the world on receipt of twelve stamps. Estimates for work at home or abroad.

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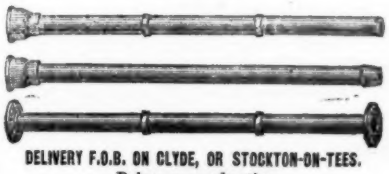
GAS AND WATER PIPES.

WILLIAM MACLEOD & CO.,

18 & 20, ALSTON STREET, GLASGOW.

CAST-IRON GAS AND WATER PIPES.



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Prices on application.

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SHOTT'S BOGHEAD.

LOTHIAN'S CANNEL

Yields 12,500 cubic feet of 34-candle gas per ton, and 9 cwts. of excellent coke, containing only 4 per cent. of ash.

MUIRKIRK, No. 1, CANNEL

Yields 12,160 cubic feet of 32·5-candle gas per ton, and 10 cwts. of excellent coke, containing only 5 per cent. of ash.

OLD WEMYSS CANNEL

Yields 13,320 cubic feet of 32·5-candle gas per ton.

Prices and full Analyses on application.

ABRAM GAS COALS

from the

BICKERSHAW PITS, WIGAN,

Of the Abram Colliery Company, are worthy the attention of gas producers, showing a good yield of gas and a large residuum of excellent coke. When blended with one-seventh cannel, the gas is of specially high illuminating power.

Copies of analysis made at the Gas-Works, Salford, with an apparatus of full size, prices, and particulars of

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LORD DOUGLAS'S

(EARL OF HUME'S)

LESMAHAGOW

MAIN SEAM CANNEL COAL.

CRAIGNETHAN GAS COAL CO.,

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Analysis and Price on Application.

SCOTCH GAS COAL.

ROBERT CRAWFORD & CO.,

GAS AND STEAM COAL MERCHANTS,

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Supply and Contract for all the principal Scotch Gas Coal (including BOGHEAD, HARTHILL, CHAPELSIDE, LESMAHAGOW, and BRAEHEAD), f.o.b., or delivered at home or abroad.

ENGLISH AND WELSH COAL AND CANNELS ALSO SUPPLIED.

Analyses and Prices on application.

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AXWELL COLLIERY COMPANY,

Near NEWCASTLE-ON-TYNE,

SUPPLY CANNEL COAL FROM THE ABOVE COLLIERY.

Analysis—10,000 cubic feet of Gas per ton of Coal, having an illuminating value equal to 26 standard sperm candles, with a yield of 13¼ cwts. of Coke per ton of Coal.

Supply also Gas and Coking Coals from the best seams.

Shipments at Tyne Dock and South Dock, Sunderland.

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One ton yields 12½ cwt. of good coke. This Coal can be shipped from Hull, Goole, Liverpool, Morecambe, and Barrow.

For further particulars, apply to POPE AND PEARSON, LIMITED, West Riding and Silkstone Collieries, near LEEDS.

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The Subscriber is prepared to contract for the supply of all the principal SCOTCH CANNEL COALS. Prices and Analyses of the various Coals will be forwarded on application.

JAMES M'KELVIE,

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Established 1840.

C. T. GRANT & CO. COAL BROKERS GLASGOW.

Scotch Churls

PRESENT PRICE:

5s. 6d. per Ton at Pit.

8s. 9d. ,, F.O.B.

Cubic Feet.	Illuminating Power.	Coke (sup. qual.).
10,000 ..	20 candles. ..	12 cwt.

C. & W. WALKER'S WOOD PURIFIER SIEVES,

Which have now been used for fifteen years, and their advantages and durability fully established. They are made entirely by steam machinery in very large quantities at the most moderate cost.

MIDLAND IRON-WORKS,

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COPPA COLLIERY, MOLD,

Beg leave to call the attention of Gas Companies to the superior quality of their

CANNEL FOR GAS-MAKING PURPOSES.

This Cannel produces in actual working, in iron retorts, 9200 cubic feet of 32-candle gas, and upwards of 11 cwt. of coke, and in clay retorts will produce 11,500 cubic feet of 25·9-candle gas.

Ports of shipment—Birkenhead or Connah's Quay.

Waggons supplied for delivery by railway to any part of England or Wales.

For particulars, prices, and rates of freight, apply to The Coppa Colliery, Mold, FLINTSHIRE.

THE

FRAMWELLGATE COAL COMPANY,

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Are prepared to supply their

SCREENED AND NUT GAS COALS.

This Coal yields 11,000 cubic feet of gas and 13½ cwts. of coke per ton.

OFFICES: ROYAL EXCHANGE, MIDDLESBROUGH.

BELGIAN CLAY RETORTS.

J. SUGG and CO., late ALBERT KELLER, GHENT.—The removal of the import duties on Earthenware permitting the entry of Clay Retorts into England, Messrs. Sugg, of Ghent, beg to draw the attention of the Gas Companies of London, and other Cities, to the very superior quality of the RETORTS manufactured by them. They can be made of any size, in one piece, and of any form. The price will be in proportion to the weight, and very moderate in comparison to their value.

Communications addressed to J. SUGG & CO., GHENT, will receive immediate attention.

FIRE-CLAY RETORTS.

WILLIAM FRASER,

INVERKEITHING,

Owner of the Works at which Fire-Clay Retorts were first made), can supply

RETORTS, FIRE-BRICKS, &c.,

to any extent.

References can be given to managers of above a hundred Gas-Works whom he supplies.

He ships at Charlestown his

CELEBRATED HALBEATH STEAM COALS,

on Navy List.

JAMES NEWTON & SONS.

(Established 1820,)

FIRE-BRICK AND TILE MERCHANTS,

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DEPÔT for STOURBRIDGE AND NEWCASTLE FIRE-BRICKS, LUMPS, TILES, and FIRE-CLAY, and every Article suitable for

GAS AND WATER WORKS.

G. J. EVESON,

GAS COAL MERCHANT,

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Delivery per Rail to any Part.

MESSRS. NEWTON, CHAMBERS, & CO.,

THORNCLIFFE IRON-WORKS AND COLLIERIES,

NEAR SHEFFIELD,

STRONGLY RECOMMEND A TRIAL OF THEIR

CELEBRATED SILKSTONE GAS NUTS.

Analysis by F. J. EVANS, Esq., Chartered Gas Company, Horseferry Road, Westminster:—

(COPY.)

	Cubic Feet of Gas per Ton of Coal.	Illuminating Power in Candles.	Coke per Ton of Coal used.	Ash in Coke, per Cent.	Sulphur in Coal, per Cent.
Silkstone Nuts . . .	10·800	15·85	12·66 cwt.....	6·0	0·69

NOTE.—The illuminating power of the gas was tested by the standard burner now used in London by the Gas Referees, under the City of London Gas Act, 1868.

Horseferry Road, Westminster, March, 1870. (Signed) F. J. EVANS.

These Nuts are extensively used by various Gas Companies throughout the Kingdom, who bear strong testimony to their value.

APPLICATIONS FOR PRICES, &c., TO BE SENT DIRECT TO THE COLLIERY, AS ABOVE.

GAS PURIFICATION & CHEMICAL Co., LIMITED,

(Successors to JOHN WILLIAM O'NEILL & CO.,)

Offices—PALMERSTON BUILDINGS, OLD BROAD STREET, LONDON, E.C.,

CONTRACTORS FOR GAS PURIFICATION BY OXIDE OF IRON.

The superiority of the material supplied by this Company is generally recognized, and it is now in use in nearly all the London and most of the large Provincial Gas-Works.

JOHN WILLIAM O'NEILL,
SAMUEL H. JOHNSON, } Joint Managing Directors.

ALBERT GAS COAL.

THE DERBYSHIRE SILKSTONE COAL COMPANY, LIMITED,

CAN OFFER A

GAS COAL

Of superior quality, delivered at any station in England and Wales.

Purified gas per ton of coal in cubic feet (average)	**10,775**
Weight of coke in lbs. per ton of coal	**1,465**

ANALYSIS AND PRICES ON APPLICATION TO

Mr. EDMUND TAYLOR, Secretary,

ALBERT COLLIERY, NEWBOLD, NEAR CHESTERFIELD.

THE LOCHORE AND CAPLEDRAE CANNEL COAL COMPANY, LIMITED.

Works: LOCHORE by LOCHGELLY, FIFESHIRE. Office: 19, MAITLAND STREET, EDINBURGH.

This Company request attention to the very superior quality of their Cannel Coals.

1. The following are the practical results given by Dr. Wallace, of Glasgow, of analyses of their Lochore and Capledrae Cannels:—

	Sample worked at Capledrae.		Sample worked at Lochore
Gas per ton of coal, at 60° Fahr. and 30 inches barometric pressure . .	13,095 cubic feet.	..	11,760 cubic feet.
Illuminating power, in standard sperm candles, by union jet consuming 5 cubic feet per hour, at ·5-inch pressure	32·91	..	34·83
Value of 1 cubic foot of gas in grains of sperm	780	..	836
Equivalent of a ton of coal in pounds of sperm candles	1,459	..	1,404
Durability of 1 cubic foot by 5-inch flame	69 minutes.	..	71 minutes.
Gravity of the gas (air = 1000)	596	..	594

Remarks.—This (the sample from Capledrae) is a Cannel Coal of first-class quality, giving 13,000 feet of 33-candle gas. It contains only a minute proportion of sulphur, and the ash is almost quite white. The coke is of rather inferior quality.

Remarks on Sample from Lochore.—This is a Cannel Coal of first-class quality, giving a large yield of very rich gas and a coke of medium quality.

2. The following are the practical results of analyses by Dr. Wallace of the Company's Waverley Cannels:—

	Capledrae Waverley.		Lochore Waverley.
Gas per ton of coal, at 60° Fahr. and 30 inches barometer	9,120 cubic feet.	..	11,145 cubic feet.
Illuminating power, in standard candles, by union jet consuming 5 cubic feet per hour, at ·5-inch pressure	36·62	..	33·09
Value of 1 cubic foot of gas in grains of sperm	878	..	794
Equivalent of a ton of coal in pounds of sperm candles	1,145	..	1,264
Durability of 1 cubic foot of gas by 5-inch flame	80 minutes.	..	67 minutes.
Gravity of the gas (air = 1000)	677	..	597

Remarks on the Sample of Capledrae Waverley.—This Coal gives fully 9000 feet of gas of 36½ candles, and is admirably adapted for bringing up the quality of gas made from common coal or inferior qualities of cannel. The tests were made at a rather high temperature, this being one of the coals that stand a very high heat without serious diminution of the illuminating power of the gas The coke contains 60 per cent. of ash, and is therefore almost valueless, but the proportion of sulphur is very moderate.

Remarks on the Lochore Waverley.—This is a first-class Cannel Coal, giving 11,000 cubic feet of 33-candle gas. The quantity of sulphur is very minute, and the ash is nearly white. The coke is of inferior quality, but not wholly valueless.

Applications for full Copies of Analyses and Prices may be made to the Company, at

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DRY GAS-METERS,

PRIZE MEDALS.
LONDON, 1851;
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COMBINING ALL THE LATEST IMPROVEMENTS,

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Of the highest excellence.

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Of the most perfect description for all purposes relating to Gas.

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CONSUMERS IMPROVED WET GAS-METERS,

THE UNVARYING WATER-LINE GAS-METERS,

IMPROVED DRY GAS-METERS, in Cast-Iron or Tin-Plate Cases;

STATION-METERS, ALL SIZES, up to 15 feet Square, with PLANED JOINTS;

Experimental Meters, Photometers, Pressure-Gauges,
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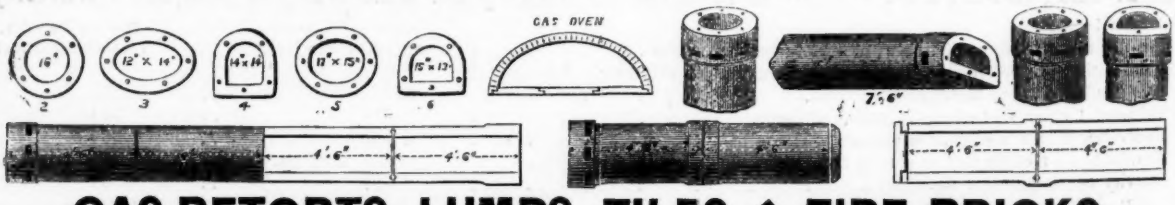

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